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Charles D. Walcott

A MONOGRAPH

OF THE

EOCENE BIVALVES

OF

ENGLAND.

Supplement

BY

SEARLES V. WOOD, F.G.S.

VOLUME I.

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PREFACE.

In the year 1846 Mr. G. B. Sowerby proposed to publish at intervals a series of Plates illustrative of the Crag and London Clay Fossils, to which Mr. Edwards and myself had undertaken to supply the descriptions. It was contemplated to issue alternately a number of each formation in furtherance of this object. The first of these serials was to be upon the Crag; and at the meeting of the British Association, held in September, 1846, at Southampton, a specimen plate of the Crag Fossils was exhibited. In January, 1847, Dr. Bowerbank conceived the idea of establishing a society for the purpose of figuring and describing the fossils of Great Britain, in which he was supported by Dr. Fitton, the late Dr. Buckland, and other influential Geologists. There was then in existence a private association, called the London Clay Club, which was composed of a limited number of Tertiary Geologists, who assembled periodically at each other's houses for the study of Eocene Geology, and this was looked upon by the promoters of the contemplated new society as a good promise of material for its support. The desire of encouraging such an object rapidly extended, and a large number of gentlemen speedily enrolled themselves as members of the new society. The Crag Formation had been well examined by myself, and as it appeared to be one that was best known, seemed to offer to the friends of the undertaking the most fitting opportunity for commencement; and as I was particularly desirous of having the Crag fossils figured and described, I conceived this a more certain mode of extending the knowledge of the contents of that formation than the one I had previously entered into, and made arrangements accordingly with Mr. Sowerby for the alteration, and set to work immediately upon the portion allotted to my labours. My friend, Mr. Edwards, as before stated, intended to publish parts alternately with myself; but the older Tertiary Formations being much richer in species, his portion of the work was not so readily prepared as that of the Crag; moreover, what at that time appeared a feasible mode of proceeding has, by the course of events, become

altered, and the known Eocene Mollusca intended to be comprised in his work have since then been so largely augmented in number, as seriously to impede his progress, and to compel him to change his original intention. The prospect once entertained by Mr. Edwards of completing the whole of the Eocene Mollusca thus became so remote that he proposed to me that, as my monograph on the Crag was finished, I should describe the Bivalves of the older Tertiaries.

From a knowledge of the amount of labour my friend has before him ere he reaches the termination of the Univalves, which must occupy him for many years to come, I was induced to consider whether any assistance that I could render in the illustration of these fossils would not be of service to the science of Geology. I felt at first especially reluctant to interfere in any way with a work that has been so ably conducted, but the great desire expressed by Tertiary Geologists to possess an illustration of the Mollusca of the Eocene period in this country still unfigured and undescribed was an inducement to make all other considerations subordinate to that imperious want, and on that ground alone I have consented to attempt to supply such a desideratum. Mr. Edwards has in the most liberal manner promised to place the whole of his Bivalves in my hands, as they may be wanted for examination. His collection of these fossils is the most perfect I have seen, and as the work was intended to be done by himself, the type specimens have and will be taken from his cabinet, except where otherwise particularly expressed; and the principal localities will be introduced on his authority. Mr. Wetherell, Dr. Bowerbank, Mr. Prestwich, the Rev. Osmond Fisher, and all my geological friends, have most kindly permitted me the use of any specimens in their cabinets, and I have to return them my best thanks for their assistance, without which my work would be very incomplete. Mr. Wetherell's collection is particularly rich in the fossils of the London Clay from the north side of London; and Dr. Bowerbank's more general collection possesses some choice and unique specimens. To Mr. Prestwich I am further indebted for some of his typical specimens, and more especially for his assistance in regard to localities. Neither must I omit to mention that our national museums contain many specimens that have already been used for the illustration of the Bivalves of these older Tertiaries, or which will materially contribute to that object; and I beg to express my obligations to the conservators of these treasures, who have in the most handsome and friendly manner given me every possible facility and assistance in the promotion of my undertaking. The utmost desire of every one connected with Palæontology appears to have been shown to assist in forwarding the good work undertaken by the Palæontographical Society.

S. V. WOOD.

March, 1861

BIVALVIA.[1]

INTRODUCTION.

The Bivalvia constitute the third portion of the still greater division of the animal kingdom called Mollusca, from the word *mollis*, a term that might by hypercritics be considered objectionable, conveying as it does an erroneous impression, the exterior covering of these animals being in most instances particularly hard, more so than the internal skeleton of the Vertebrata. Bivalves are acephalous, or animals without a head, but they are furnished with a (generally) large and powerful mass of flexible material, called a foot in consequence of its being the principal organ of locomotion; this is of importance to the Palæontologist, inasmuch as the opening or sinuated edge of the valves at the margin is modified by the magnitude of this foot. It is supplied with circular fibres for extrusion, and longitudinal fibres for retraction. Although some of these animals are capable of changing their places

[1] In the second volume of the 'Crag Mollusca' the word "Bivalvia" is employed for those animals that are without a head, and are enclosed within two valves or pieces of calcareous covering, and it is repeated here for the same group. This name appears to me to possess the greatest claim on account of its priority of date, and it is most expressive in its application. An objection has been made to it, that it does not include the Brachiopoda, which are also enclosed within two valves, but the same want of isolation may be urged against the rival claims of Acephala, Conchifera, and Lamellibranchiata. The meaning of each of these names is not restricted to the characters of the animals they are intended to represent, and the advantages they offer are not, in my opinion, sufficient to entitle either to supersede the earlier name of Bivalvia. The Committee of the British Association, in their 'Rules and Regulations for Nomenclature' proposed in the year 1842, and recommended that "The law of priority should be admitted as the only effectual and just one," but that it should not extend to authors anterior to Linnæus (ed. 12th, 1767). The adoption by me of the above name is in compliance with those recommendations.

of abode, many remain all their lives in a stationary condition; some are moored by a cable or byssus, secreted for that purpose, by the foot; others are located in an excavation which is formed when young, and gradually enlarged to supply the increasing wants of the growing animal. In regard to magnitude, they present a large amount of variation; the adult shell of *Erycinella ovalis* is less than a line in its greatest diameter, while a specimen of *Tridacna gigas* in the museum at the India House has a longitudinal diameter of four feet, giving a difference of more than five hundred in linear dimensions; and the weight of a united pair of valves of *Kellia pumila* is a fraction of a grain, while *Tridacna* is said, with its animal, to exceed six hundred pounds, and these extremes, though not quite equal to those of the Vertebrata, do not fall very far short of them.

Bivalves in the early period of the world's existence constituted a much larger proportion of the Mollusca than the Univalves (if that designation be confined to the Gasteropoda), although much inferior in number to the Brachiopods. In these proportions, however, very considerable alterations take place as we approach the present time, in which the Bivalves are in the minority compared with the Univalves, but largely in excess of the Brachiopods, the Univalves appearing to have taken the place of the Tetrabranchiate Cephalopods, which were extensively developed during the earlier and middle periods, but have now, with the exception of one genus, disappeared. The Brachiopods materially diminish while the Bivalves as steadily increase up to the Tertiary periods; and although collectively the Bivalve species that have lived, but are no longer in existence, exceed in number those of the present day, yet at no single period will they bear a comparison with existing species until we approach the older Tertiaries, their proportions during that period being not very different to what they are at the present day, if we take into consideration the comparatively limited areas that have been examined in search of fossils.

Bivalves succeed the Univalves in a natural arrangement, the latter being more highly organized, having an imperfect head with eyes more or less developed;[1] the former have, however, a mouth and digestive apparatus deeply inclosed within the mantle and its calcareous covering. According to Drs. Carpenter and Bowerbank, the shell is formed by the secreting action of the epithelial cells covering the mantle of the animal, and it is enlarged solely by the increase to the margin of the shell, that is, by a rib or band of shelly matter being added to the external edge of the previously formed shell. The mantle or cloak which envelops the viscera, though not the most vital organ, is the most important one to the Palæontologist, as by this the shell is formed, and on this the shell is moulded, and the species is determined by what this mantle has deposited. This calcareous covering is exceedingly variable in its composition and solidity; in some species the animal appears to possess the power of secreting a large amount of mineral matter, in others the shell is particularly thin and semi-transparent; in some it is of

[1] Species in the Genus *Pecten*, as also some in the Genera *Arca* and *Pectunculus*, have the margin of the mantle studded with spots, "*ocelli*," and these are said to be rudimentary eyes, but they are very imperfect organs of vision.

enormous thickness, highly calcareous, and with only a small cavity for its inhabitant, while in others the shell is nearly corneous, and in some the soft parts, as they are called, constitute almost the entire animal, the mantle having but a very thin coating of calcareous matter.

Marine shells, as a general rule, are thicker than those which inhabit fresh water, but in both the variation is occasionally excessive. *Ostrea* and *Pholadomya* may be cited as examples of the extremes of thickness and tenuity in the case of marine Bivalves; *Unio* and *Cyclas* in those of fresh water. In all these cases, solidity or tenuity of substance does not appear to have been regulated in the animal solely by the want of a protective covering as a preservative to its specific existence.

Fresh water Bivalves, like the Terrestrial air-breathing Univalves, do not exhibit the great specific variation that we see in marine animals of the same class. We might naturally expect this to be so in regard to shells inhabiting fresh water, when so small a space is occupied by these animals in comparison with that on which their marine congeners live, but why the land Pulmonata should in specific enumeration be inferior to other Mollusca is not by any means satisfactorily explained; the bands round the coast lines which contain nearly the whole of marine Molluscan life being far more limited in their dimensions than the feeding-ground occupied by the Pulmonata, which may be taken as the chief part of the land area generally.

The headless animals which compose this group, or the division of it called the Dimyaria, are nourished and sustained by two siphonal tubes, formed by a prolongation of the mantle, the one inhalent, and the other exhalent; the former being that through which the water containing the particles of nutrition is conveyed to the mouth, and for aërating the branchiæ, and the latter that which carries off the water after this duty has been performed. The animals which are furnished with these prolongations are necessarily supplied with muscles for their extension, as also for their retraction; and as a considerable space is required for the play of these tubes, an impression is generally formed by the retractor muscles upon the interior of that part of the valve, indicating the length or extent to which they are or have been capable of protrusion, and the depth of the sinus in general corresponds with the presumed extent of the siphons.

Bivalves are all aquatic, and breathe entirely by means of gills or branchiæ, and these consist usually of four riband-shaped lamellæ, two of them attached to each lobe of the mantle; water, therefore, is in their case necessary to sustain life; a few species, however, appear to be able to retain a sufficient quantity of moisture to enable them to live for a considerable time out of water. Shells often acquire an increase of material where there is a superfluity of lime within their reach, and become too ponderous for any apparent requirements of the animal.

Most shells in the living state are covered with an outer pellicle or coating, called the epidermis, a material more animalized, that is to say, there is less of lime in its composition, and therefore, under ordinary circumstances, less capable of preservation

in the fossil state. This is also exceedingly variable, being thick and opaque in some species, while in others it is thin and transparent, and in many glossy and polished shells it is entirely absent. The epidermis is said to be a protection to the shell against the chemical action of acids held in solution by the water; but many fresh- and salt-water species, although covered with a thick and woolly epidermis, suffer materially by the erosion of the shell, while those that are less protected by this covering appear to escape altogether. It is at the umbones, or that part of the shell which is most remote from the more vital portions of the animal, and in those species which appear to contain a less quantity of animal matter, that the ravages are committed. In some glossy and polished shells, such as in the Venus tribe, there is a total absence of epidermis, and these do not suffer from erosion.

The two valves are held together by an elastic ligature: this has been called *ligament* when it is situated on the external part of the shell, and *cartilage* when it is internal; but as this fastening is sometimes composed of a portion of each, we are on those occasions unable to characterise it by either of those terms *alone*, and I think it ought to have a peculiar name for its joint and general service; I propose, therefore, to call it *connexus* (the connector). When this ligature is external, it acts over a support or fulcrum, and by its elasticity contracts in order to open the valves; it is then *ligamentous*. When it is placed within the outer margin of the shell, it is *cartilaginous*, opening the valves by its expansion; and when it partakes the double character of ligament and cartilage, it is *amphidesmous* or *bipartite*. This elastic material is then extended both outwardly and inwardly, and although in this case the ligament and cartilage are united, there is always a slight elevation or partition between them, and this forms the fulcrum over which the ligament acts. The two pieces of the Bivalve are thus naturally kept open by the elasticity of the ligamentous portion in its contraction, and by the cartilaginous in its expansion, and when the two valves are closed in the living animal it is by the contraction of the adductor muscles. In the fossil state Bivalves are of course often found in their natural position, that is, with the margin of the valves separated in the way the dying animal has left them on the relaxation or rather paralysis of the muscles, but the two valves are as often quite closed; this, of course, must be from external pressure overcoming the action of the connexus.

Although the two valves are kept together and held in position by the connexus, they are often further secured by prominent processes, called teeth, which prevent a lateral motion; these are said to be strong and prominent where there is weakness in the connexus, and, as a general rule, amongst the Dimyaria the observation is more applicable to those shells where it is on the outside (*i. e.* ligamentous), while in *Mya*, *Anatina*, &c., which have the connexus internal (*i. e.* cartilaginous), there are no prominences or teeth. This rule, however, like most others, is not without exceptions; *Nucula*, *Leda*, *Mactra*, &c., have the dorsal margins furnished with numerous and prominent interlocking teeth; perhaps, as a general rule, the more locomotive species have the strongest hinge. The dental apparatus, in

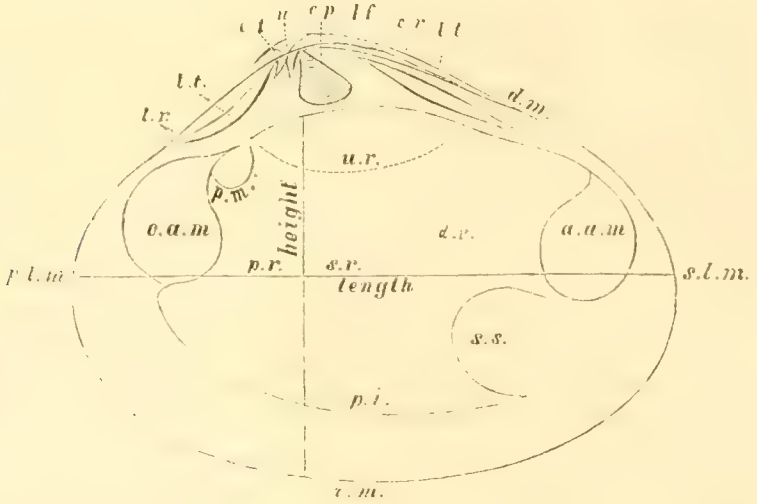
conjunction with the *connexus*, constitutes the hinge on which the valves open and close. The *Brachiopoda*, which have also two valves, differ from *Bivalvia* in wanting the connecting ligament, and the opening as well as the closing of the valves is in that class effected by muscles; they differ also in having one valve perforated, through which the byssus passes, and as this opening is enlarged during the growth of the animal, the infant state of that perforated valve is *entirely* destroyed, but the infant state of the *Bivalvia* is visible in both valves at all ages in the umbonal region of the adult shell.

The adductor muscles of the Dimyaria are generally of the same magnitude, or at least nearly so; where there is a difference, it is in those animals whose shells are greatly inequilateral, the larger portion then requiring somewhat greater power in closing the valves. The pedal and siphonal regions are easily known in most species, even in the equilateral or orbicular shells, by the position of the connexus when it is only on one side of the umbo, as in that case it is always more or less on the siphonal side, even in those shells where it is wholly internal or cartilaginous; but in genera, such as *Pectunculus*, *Limopsis*, and the equilateral *Areæ*, which have the connexus spread over a large area equally on each side of the umbo, it is by no means so readily determined. The siphonal region may, however, be generally recognised by the impression of the anal adductor being somewhat higher up, permitting the openings for the incoming and outgoing currents to pass beneath it, and the oral adductor is slightly prolonged by the union of the pedal muscle, which in these animals is required to move their large and expansible foot.

The Bivalve shell has always been described as having an anterior and a posterior extremity, and it would be desirable still to retain that general description, if it were not for the diversity of opinion there always has been, and which still exists, amongst conchologists, as to which should be considered the anterior and which the posterior portion of the animal. It is at times difficult to determine, in descriptions, which is intended by the author as the anterior, and which as the posterior, for these terms are sometimes employed conversely. I believe the animal in its shell will sufficiently denote the anterior and posterior of itself by the position of the mouth and anus, as in all animals where these are separated the first is considered anterior and the last posterior; but in the *Bivalvia* it is said by those who advocate the reverse of this, that the indrawing tube of the animal by which nutriment is conveyed to the palpi, and thence to the stomach, is on that part which by some is called posterior, but which ought, on that account (they say), to be called the anterior, and also that this portion, in all boring Bivalves, for example, is always the uppermost or anterior in their retreat.

I have therefore thought it expedient in this monograph to substitute for these terms an alteration by which, it is hoped, the confusion may be avoided. That which I have called the pedal region ought perhaps, more strictly speaking, to be considered as the buccal region, and the opposite one the anal, but the Palæontologist is more especially concerned with the shell and its interior, which bears the impress of the muscles only, and not of the viscera, or at least very rarely so. I have thought it better to employ those

terms with which the conchologist, rather than the malacologist, is most familiar; I therefore introduce a figure with a formula of explanation, making as little alteration in existing terms as possible.



u. Umbo.
u. r. Umbonal region.
p. r. Pedal region.
s. r. Siphonal region.
l. r. Lunule region.
c. r. Corslet region.
d. m. Dorsal margin.
v. m. Ventral margin.
p. l. m. Pedilateral margin.
s. l. m. Siphonilateral margin.

c. p. Cartilage pit } connexus.
l. f. Ligamental fulcrum }
p. m. Pedal muscle.
o. a. m. Oral adductor muscle.
a. a. m. Anal adductor muscle.
p. i. Pallcal impression.
s. s. Siphonal sinus.
c. t. Cardinal teeth.
l. t. Lateral teeth.
d. v. Depth of valve.

A considerable difficulty exists in the mode of estimating the dimensions of a Bivalve, from the want of accordance amongst conchologists in denominating the different parts of the shell, the length being sometimes considered to extend from the umbo to the ventral margin, the breadth from the pedilateral to the siphonilateral margin, and the most tumid portion of the closed valves as forming its height. At other times it is the reverse of this. In my monographs I have adopted the latter method, conceiving it to be the more natural one. The base on which the animal stands is the ventral margin, and on which it is moved by the foot in all those which are locomotive; therefore the height should be from that base to the vertex or umbo, and the length consequently should be taken in an opposite direction, while the tumidity of the valves may be considered the depth, and the substance of the shell its thickness.

In the Dimyaria, which are generally transverse shells, and have a greater diameter from the pedal to the siphonal region, there is no difficulty in thus considering these various dimensions; but with the orbicular shells, or with those whose elongation is from

the umbo to the ventral margin, such as *Lima*, *Vulsella*, *Ostrea*, &c., we are much perplexed with the application of these terms, as we meet sometimes with a shell whose height will exceed the length two or even threefold, and the longest diameter in that case is in ordinary parlance called the length, and this is often so employed by those who estimate generally the length of the Bivalve from the pedilateral to the siphonilateral margin. The same terms ought in our descriptions to be employed for such shells as *O. Virginica*, as is done to those like *Solen*, &c., where the longest diameter is in an opposite direction.

The older Tertiary species of England are, I believe, with a very few doubtful exceptions, all extinct, but they have a generic representation among existing forms. This, of course, must depend upon what is to be accepted as sufficient for a generic distinction.

A genus is said to consist of a group of species related by community of structure and parts comprehending all essential characters. In Bivalves the *number* and position of the hinge-teeth, as also the position of the connexus, whether external or internal, are considered by some authors sufficient, when separately estimated, to characterise a genus; while others will regard some of these distinctions as unimportant, or, at least, of only specific value.[1] The definition of a species is equally unsatisfactory; it has been given in the following formula:—"All specimens or individuals which are so much alike that we may reasonably believe them to have descended from a common stock (parent or parents), constitute a species." It is, however, found in the practical examination of individuals that the line between these groups is generally so ill-defined that we are led to doubt whether there is in nature any such distinction as we find it convenient to make in order to suit our own purposes. Great authorities say that "no general rule can be laid down for determining the distinction of species, as there is no particular class of characters which can serve as a criterion. In each case we must be guided by *analogy and probability*." It thus appears that our determination is mainly dependent upon individual opinion, and we have nothing whereby it can be decided that the conclusion of any author is the correct or real one. Those only who have laboured hard to fix the limit of a species out of a multitude of specimens, of similar or proximate forms, can tell the uncertainty attending the determination of such a distinction, and the unsatisfactory conclusion at which the naturalist often arrives; and when the varying opinions of preceding authors are weighed

[1] In order to show the difficulties which exist in characterising such a section, we may take the Genus *Lucina* as an example. This Genus, as admitted by several modern authors, contains shells possessing differences which, in other portions of Bivalvia, are considered as being in themselves separately entitled to generic distinction. Thus, *Lucina* comprises: 1st, shells without hinge-teeth; 2dly, shells with cardinal teeth only; 3dly, shells with one lateral tooth; 4thly, shells with two lateral teeth. This genus also contains species in which the connexus is both outward and inward: 1st, those in which it is wholly external, with a thick and solid shell, such as *L. columbella*; 2dly, those in which it is amphidesmous, with a thin and almost diaphanous shell, such as *L. flexuosa*; 3dly, those in which it is situated internally, opening the shell by expansion, as in *L. lactea*; besides these differences, some species are perfectly plain and free from sculpture, while others are beautifully ornamented, and the animal also partakes of the varying characters of the shell.

and critically examined by their successors, we are so much nearer a successful decision only by a more general concurrence of opinion in favour of one set of determinations than of the other.

The duty of the Palæontographer is to give good figures and copious descriptions, in the hope to secure similar determinations by the largest number of those naturalists who have well studied the intricacies of the subject, and thus to afford a test by which those who succeed may gauge and determine the value of his conclusions.

The difficulty which, in the course of my study of the Mollusca, I have frequently encountered in assigning the true specific value to forms which, in a series of individuals, exhibited such an approximation to other forms called specifically distinct, long since raised in me a doubt of the reality of specific distinctions as a fact in nature, which reflection upon the general nature of organisms matured into a conviction that all organisms originated by a natural process of slight variation accumulating in a given direction out of other and pre-existing organisms. I was therefore, fully prepared for the enunciation of the theory of Mr. Darwin, that all forms have originated by selection, and I readily concede that process to be one of the most powerful, if indeed it be not the sole cause of all the varied forms of being that have peopled the earth. Nevertheless, specific distinctions, empirical or artificial though they may be, must always be to a certain extent recognised as essential to the proper working out of our knowledge of Palæontology, and particularly to a correct apprehension of the true ages of geological formations, and of the reduction of those widely severed in area to a common horizon. The general recognition, however, of such an origin for organisms, if indeed that ever be conceded by reluctant Palæontologists, will, in addition to the importance of the discovery of so great a truth, be no little boon to the hard-working naturalist, whose labours have been seriously aggravated by a desire for species making.

It is intended here to describe all the species of British Bivalves belonging to the Eocene or older Tertiaries of England; these, with the Crag and overlying deposits, constitute the Tertiary remains in this country.

The great Eocene Formation in England has been separated into ten distinct series of deposits, viz., the Bembridge, Osborne, Headon, Barton, Bracklesham and Bagshot series, the London Clay, the basement bed of the London Clay, the Reading and Woolwich series, and the Thanet Sands. These divisions are based principally upon geological and lithological evidence. I have not been able to characterise these various distinctions by their organic contents, but have merely introduced the localities of the different species so far as they are known to me.

The Marine Fauna of the Eocene Deposits appear to have their connexion with the existing types of the eastern seas, where several of the Eocene genera are only now to be found; this is rather more strongly displayed by the Cephalopoda and Gasteropoda than by the Bivalves, although in this latter division we have not less than seven genera now confined to seas lying south-east of this country, viz., *Vulsella*, *Cucullæa*, *Cardilia*,

Fimbria, *Thetis*, *Cultellus*, and *Limopsis*.[1] In the higher group of Mollusca as many as twelve genera may be enumerated, viz., *Nautilus*, *Pterocera*, *Seraphs*, *Harpa*, *Metula*,[2] *Borsonia*, *Rotella*, *Pyramidella*, *Niso*, *Nematura*, *Phorus*, and *Parmaphorus*, also now confined to the south-eastern seas, and these genera appear to represent a relationship to the Marine Fauna of the Eocene period more especially than any others I can instance.

The land and fresh-water species have, I think, on the contrary, retired in an opposite direction, as their connexion appears to be more especially with the existing types of the American Fauna. Mr. Edwards has described fifty-seven species of Pulmonata from our Eocene Deposits, of which only ten, he considers to be identical with fossil species of the European Continent, and this I imagine arises from a difference in the direction of the rivers which flowed into the Paris Basin Sea, and which were quite distinct from the one that is presumed to have been emptied into the Hampshire Beds.

The Bivalves now to be described comprise species of fresh-water animals as well as those from estuarine and marine deposits of the great Eocene Formation in this country. The estuarine animals were, no doubt, shallow-water species, and the principal part of the marine from the littoral or sub-littoral zones; the deep-water portion of the period being, in all probability, the great Nummulitic deposit. We are able, in some degree, to surmise the probable depth of the sea of a marine deposit, from the collective indications of the various genera it contains, whose habits are presumed to be similar to those of existing analogues, but even in these suppositions extreme caution ought to be observed. The dredgings of Mr. M'Andrew and others, among existing Molluscs present us with anomalies, which show that in some genera, as, for example, in *Chiton*, *Trochus*, &c., which generally inhabit the littoral zone, species have presented marked exceptions to this rule, as they have been found alive in deep water only. A conclusion, therefore, drawn from a *single* extinct species can not be entirely depended upon, inasmuch as the habits of the animal might have resembled those of the exceptional cases in existing genera.

[1] This genus has one species living in the Red Sea, one at Singapore, one off the Cape of Good Hope, and one (perhaps two) have been found in the North Seas. These last are probably the prolonged existence of the Crag species; otherwise the generic relationship is with the south and east.

[2] Mr. P. Carpenter has, in his valuable 'Report on the Mollusca of the West Coast of North America,' introduced four species, but the generic name is accompanied by a mark of doubt.

ANOMIA. *Linn.*, 1767.[1]

Generic Character. Shell inequivalved, irregular and variable, subequilateral, ovate or suborbicular, and slightly pearly within; upper or left valve convex, smooth, lamellar, striated, costated or muricated; lower valve flattened, sometimes very slender, with a large foramen, through which passes a calcareous appendage, or calcified byssus, for the attachment of the animal. One muscular impression in the lower or fixed valve, and four in the upper. Connexus cartilaginous; hinge edentulous.

Animal unsymmetrical, with the edges of the mantle disconnected, except at a small spot near the hinge; its margin double, slightly fringed, without ocelli or rudimentary eyes; foot very small, cylindrical, expanded at the end, and grooved; byssus large, passing through a nearly complete foramen in the right mantle lobe, and attached by a powerful muscle to the centre of the left valve. One adductor muscle; palleal line continuous. Sexes distinct.

The impressions of four muscles are left upon the interior of the upper or left valve; one of the four is that of the adductor, and is the only one impressed upon both valves. The largest of these muscle-marks is the attachment of the byssal plug; probably the two centre marks belong to that organ, and the small one in front of the cartilage-pit is caused by the retractor of the foot. The animal cements itself to the rock by the byssus, which contains so much calcareous matter that it becomes as hard as the shell itself, and this plug is found in the fossil state in the upper, though I have not yet seen it from the lower, Tertiaries.

The right or adherent valve is very thin, oftentimes almost obsolete, and in some species it is much less in size than the upper, so that the mantle extends considerably beyond the edge of the shell, showing the lower valve to be almost useless; the perforation of this valve in some species is very large, with an unconnected margin; indeed, this is the more common character. The cartilaginous connexus is placed on a projecting piece of this valve, behind which the shell is thickened with a sort of double ridge running into the body of the valve; this is often the only portion preserved in the fossil state, and I now find that to have been the condition of the little Crag fossil, which I imagined to have been the internal shell of a Gasteropod, and figured in the 'Crag Mollusca,' doubtingly, under the name of *Aplysia*.

The umbo of the upper valve in some specimens of this genus is removed to a considerable distance from the margin of the shell, and in its exterior makes, in appearance, an approach to the limpets. The large and extended muscle-marks of the interior

[1] For generic synonyma see 'Crag Mollusca,' Part "Bivalves."

also resemble the impression of the adductor in some of the capuloid shells, more especially those of the Genus *Hipponyx*, in which the animal constructs a shelly base resembling a second valve, and the adductor in that Gasteropod has the twofold purpose of the Bivalve muscle, adhering to the shelly base as well as to the interior of the conical shell, forming and leaving a similar mark deeply impressed upon the inner surface of each piece, the muscle extending itself behind the foot, and this otherwise large "belly-foot" of the *Hipponyx* is contracted to permit it to take hold of the shelly base. These impressions in *Anomia* indicate the presence of powerful muscles, although the animals possess little more than the rudiments of a foot. The genus is far removed from those animals which have only one piece of shell (the Univalve), but they are perhaps nearer than any other Bivalves, and they are, I think, appropriately placed here at the head of the list.

In the recent state, this genus has an extensive geographical range, species belonging to it are found in America, India, Australia, the Mediterranean, and the North Seas. It is not numerous in species, either as recent or fossil.

1. Anomia tenuistriata, *Deshayes*. Tab. IX, fig. 1, *a*—*c*.

Anomia striata. *J. Sow.* (non striata, *Broc.*, 1814). Min. Conch., t. 425, 1823.
— — *Galeotti.* Mém. Cour. par l'Acad. Brux., t. xii, p. 151, No. 89, 90.
— ephippium. *Defrance.* Dict. des Sc. Nat., t. 2, 1823.
— tenuistriata. *Desh.* Coq. Foss. des Env. de Par., t. 1, p. 377, pl. 65, figs. 7—11.
— — *Sow.* In Dixon Geol. of Sussex, p. 117, t. 4, fig. 8; and t. 14, fig. 17, 1850.
— — ? *Grateloup.* Cat. des An. du Bas de la Gironde, p. 56, 1838.
— lævigata? *Nyst.* Coq. Foss. Belg., p. 311, pl. 26, figs. 4—6, 1843.
— orbiculata? *Id.* - - - p. 312, pl. 25, fig. 6, *a*, *b*.
— lineata. *J. Sow.* Min. Conch. Syst., index, 1835.
— — *Morris.* Catal. Brit. Foss., p. 161, 1854.
Anomya tenuistriata. *D'Orb.* Prod. Palæont., p. 395, No. 1148, 1850.
— substriata? *Id.* - - p. 396, No. 1150, 1850.
— sublævigata? *Id.* - - p. 396, No. 1149, 1850.
Ostrea anomialis. *Lam.* Hist. des An. sans Vert., t. vi, p. 220, 1822.

Spec. Char. A. testâ tenui, suborbiculari, irregulari, valdè inæquivalvi, valvâ superiore convexâ, tenuissimè striatâ, valvâ inferiore planâ foramine magno; umbone submarginali.

Shell thin, irregular, rounded, and finely striated externally; upper valve much the larger and convex; lower valve small, flat, and thin, with a very large opening for the plug; umbo near the margin.

Diameter, 2 inches.

Locality. Alum Bay, Barton, Bramshaw, Brockenhurst, Brook, Bracklesham, Bognor, Clarendon, Stubbington, Whitecliffe Bay (*Edwards*), Clewett's Green, Newnham (*Prestwich*), Highgate (*Wetherell*).

Belg., Env. de Bruxelles, Sables d'Uccle et de Forêt (*Nyst*).

France, Grignon, Montmirail, Senlis (*Desh.*), Blaye (*Grateloup*).

This, like most of the species in this restricted genus, is very variable, assuming a shape in some degree conformable with the place in which the individual has chosen to fix its abode; and although the generality of specimens have the upper valve convex, it occasionally happens that this valve is flat or even slightly concave outwardly: the form is sometimes elongately ovate, while at others it is elevated, but when quite free and not distorted it is nearly orbicular, as may be seen by the specimen figured, which displays its natural shape. The same habits existed in this animal as in species of the genus at the present day. One of Mr. Edwards's specimens adhered to the back of a *Pecten*, the markings and rays of which it has assumed with great regularity (fig. 1, *c*).

In the young state of this shell the striæ are wholly invisible, and, indeed, in some of the larger specimens they are only to be detected by a powerful lens; it is so in those from Clarendon, and this I imagine is the condition of those specimens to which the names of *A. lævigata* and *A. orbiculata* have been given. The muscle-marks in the upper valve are well displayed; the larger one, the muscle of the plug, is situated under the cartilage-pit, and is more than double the size of the adductor, and corresponds with the large foramen of the lower valve; the shape of this mark is modified by the shape of the shell; the upper pedal impression is close to the corner of the cartilage-pit, and I had imagined at one time that a difference in form existed between the specimens from Clarendon and those from Barton, but apparently this is not a permanent character, and these markings are all variable in outline. In the specimens from Grignon the same variableness in these muscle-marks may be observed; they assume, in a great degree, a shape much in accordance with the outward form of the shell. I am unable to detect a difference which might fairly be considered specific between any of the specimens, from the lowest to the uppermost of the older Tertiaries through which this Anomia extends. The umbo or beak of the shell is likewise an unstable character; in some specimens it is immediately on the margin, while in others it is at a little distance from it, and Mr. Sowerby says ('Min. Conch.', p. 32) that the shell, when old, is contracted towards the beak, but this condition is probably accidental, as it occurs only in some specimens.

Barton specimens seldom exceed an inch in diameter, while those from Bracklesham are double that size. I have seen only a few from Clarendon, and those were small. The shell is generally more or less tinged with a reddish-brown colour, particularly the Bracklesham specimens, and probably contained a good deal of animal matter. This species ought strictly to be called *A. anomialis*.

2. Anomia scabrosa, *S. Wood*. Tab. XI, fig. 5, *a—c*.

Spec. Char. A. testâ minutâ, orbiculatâ, compressâ, tenui; valvâ superiore costulatâ vel radiatâ, et valdè imbricatâ, imbricibus magnis et regularibus; valvâ inferiore planulatâ; foramine parvo.

Shell small, orbicular, somewhat compressed, thin; upper valve costated or radiated, with large and elevated imbrications; lower valve with a small opening.

Diameter, $\frac{1}{4}$ of an inch.

Locality. Hampstead (*Edwards*).

Two or three specimens are all that I have seen. The imbrications upon the upper valve are large and elevated, presenting a very rough exterior, resembling the surface of a blacksmith's file. The lower valve shows the round foramen to be on the left side of the umbo, from which I presume the exposed surface to be the interior of that valve.

We have thus in these older Tertiaries the prototypes of the striated and imbricated recent British species, only in excess, the one more roughly imbricated, and the other less coarsely striated.

OSTREA. *Linn.*, 1685.

Generic Character. Shell attached by the larger or lower valve, generally thick and strong, lamellated or foliated, variously shaped, irregular, inequivalved, inequilateral; upper or free valve flat or slightly concave; under valve convex, sometimes strongly marked with radiating, lamellated costæ; hinge without teeth; connexus ligamentous lodged in an elongated, triangular depression in each valve. Impression of the adductor muscle large, subcentral, that formed by the mantle entire, generally indistinct and ill-defined.

Animal with the mantle-margin double, or disunited; its edges bordered by short, tentacular fringes; foot obsolete. Sexes distinct.

The oyster fixes itself by the outside of the left valve, and as this is done generally upon a horizontal support, the valves, from that position, are called upper and lower, and although they are unsymmetrical and inequivalved, they are nevertheless bilateral, and have a right and left valve like the Dimyaria. Oysters are generally gregarious animals, although some species appear to be solitary. *Ostrea folium*, an Oriental species, secretes projecting processes or fingers, which extend from the back of the lower valve, and by which it clasps the roots and branches of trees which grow into the water, from which habit it was called *Dendostrea* by Swainson. This, of course, is done when the animal is young, or only so long as the edge of the mantle can be extended to the extremity of the processes, after which they cannot be prolonged. Some oysters are peculiarly prone to secrete a large quantity of lime, particularly where that material is abundant; and a fossil oyster from the banks of the Tagus has been found with its lower valve two feet in its longest diameter, and of a proportional thickness. The oyster, in general, is adherent in the younger state, but when it has grown large and heavy it ceases to increase the attachment, and enlarges the shell, like a free Mollusc. Some species adhere only by a very small portion of the shell, while others are attached by nearly the whole of the outer surface of the lower valve; this character is, however, variable, even amongst individuals of the same species. The genus inhabits salt water, although the common edible oyster will live in rivers in England where the water at low tide is nearly fresh.

The age of the oyster is probably various in different species; *O. edulis* is said to live

about ten years, but to come to perfection in four or five. Fishermen pretend to be able to tell the age of this Mollusc by the discoloured fimbriations upon the lower valve, somewhat like the hybernating marks upon the snail.

1. Ostrea adlata, *S. Wood.* Tab. V, fig. 3, *a—c.*

Spec. Char. O. testâ minimâ, ovato-elongatâ vel irregulariter cuneatâ, apice obliquo; valvâ inferiore radiato-costatâ, plus minusve profundâ; valvâ superiore planiusculâ vel convexiusculâ; marginibus supernè granoso-plicatis; impressione musculari sublunari.

Shell small, ovately oblong, or irregularly wedge-shaped, apex oblique; lower valve radiately costated, more or less deep; upper valve flat or convex, margin near the hinge crenately plicated; muscular impression sublunate.

Longest diameter, 1 inch nearly.

Locality. Hempstead, Isle of Wight (*Edwards*).

There is something peculiar about this little shell which seems to entitle it to an isolated position, and I have, in consequence, given it a new name. It is a miniature representation of *O. flabellula*, but the costæ are fewer and do not appear to be visible in the young shell. All the specimens I have seen are attached to *Cerithium plicatum*; this, perhaps being the most abundant univalve in the deposit, has been selected for that purpose, and the oyster has sometimes fixed itself in the direction of the height of the univalve, by which it has become elongated from the umbo to the ventral margin, and has thereby altered the natural form of the shell. In one or two specimens the costæ are obsolete or scarcely visible, and the margins of the valves near the hinge appear to have interlocked; having crenulations in the right valve corresponding with depressions in the left for their reception. The cylindrical support of the animal has not only reduced the depth or capacity of the lower valve, but this internal prominence has communicated its form to the upper valve, making it very convex. It is similar in habit to *O. mutabilis*, Desh. Coq. Foss. des Env. de, p. 344, pl. 56, f. 9-10, but that species does not appear ever to have had its lower valve plicated.

2. Ostrea aliena, *S. Wood.* Tab. VIII, fig. 2.

Spec. Char. O. testâ tenui, ovatâ vel ovato-rotundatâ, valvâ inferiore convexiusculâ, extùs irregulariter costulato-radiatâ, sub-lobatâ.

Shell thin, ovate or ovately rounded; inferior valve slightly convex, and covered with radiating ribs or riblets, and slightly lobed.

Diameter, 3 inches.

Locality. Bracklesham (*Edwards*).

There are a few specimens of *Ostrea* in Mr. Edwards's cabinet, which I cannot satisfactorily assign to any species known to me, and I have given to them the above name provisionally.

The principal distinction is the thinness of the shell and the smallness of the hinge-area, with rather small and distant ribs in which characters, as well as in the form of the muscle-mark, it seems to differ from the young of *O. Bellovacina*, to which it otherwise somewhat approaches. I have not seen the upper valve.

3. Ostrea Bellovacina, *Lamarck*. Tab. III, fig. 1, *a*, *b*, and Tab. VII, fig. 3, *a*—*c*.

Ostrea Bellovacina. *Burtin*. Oryct. de Brux., pl. 10, figs. *a*—*d*, 1784.
— — *Lam*. An. du Mus., t. viii, p. 159; and t. xiv, pl. 25, fig. 1, *a*, *b*, 1806.
— — *J. Sowerby*. Min. Conch., t. 388, figs. 1, 2, 1823.
— — *Deshayes*. Coq. Foss. des Env. de Par., p. 356, pl. 18, figs. 1, 2; pl. 49, figs. 1, 2.
— — *Goldf*. Petr. German., t. 11, p. 15, pl. 77, fig. 2.
— — *Nyst*. Rech. Coq. Foss. de Hoesselt and Kl. Sp., p. 16, No. 41, 1836.
— — *Nyst*. Coq. Foss. Belg., p. 318, pl. 30, fig. 1, *a*; pl. 31, fig. 1, *b*; pl. 32, fig. 1, *a*; pl. 33, fig. 1, *b*; 1843.
edulina, *Lam*. Hist. des An. sans Vert., t. vi, p. 218, 1822.
— — *J. Sowerby*. Min. Conch., t. 388, figs. 3, 4, 1823.
— undulata? *J. Sow*. (non *Nyst*). Min. Conch., t. 238, fig. 2, 1819.

Spec. Char. O. testâ ovatâ, depressiusculâ, valvâ inferiore convexâ, radiatim et rugosè costatâ, et squamoso-foliaceâ; valvâ superiore planatâ, obsoletè radiatâ; concentricè lamellatâ; impressione musculari mediocri, ovato-semilunari; umbonibus subæqualibus.

Shell ovate, rather depressed, lower valve convex, with rugose, radiating ribs or ridges, foliations squamose; upper valve nearly flat, and obsoletely ridged by lamellated lines of growth; muscular impression of a moderate size, ovately lunate; umbones nearly equal.

Longest diameter, 4 inches.

Localities. Charlton, *var.* α, Dulwich, *var.* β (*Edwards*).
France, Hauteville, Beauvais (*Lamarck*).
Belgium, Kleyn-Spauwen, Hoesselt et Lethen (*Nyst*).

Oysters occur almost throughout the whole extent of the lower beds of the Eocene Formation in England, and all the specimens that have been found were for a long time considered by geologists as varieties of *O. Bellovacina*, and the geographical range assigned to this species extends from Clarendon, Pebble Hill, and Newbury, through Reading, to Northaw and Rochester, including within these outskirts the central portions of Woolwich, New Cross, &c. On expressing an opinion to my friend, Mr. Prestwich, that there were two species found in these lower beds, and my wish, if possible, to have them separated, and their proper localities assigned, and requesting his assistance for that object, I learnt from him that he had, since the publication of his paper, strongly suspected that the

numerous shells united under the name of *Bellovacina* in the lower London Tertiaries belonged to more than one species. I had hoped to have been able to assign to these their respective localities, of which not less than twenty are recorded; Mr. Prestwich fears that, without a re-examination of the ground, this cannot be satisfactorily done.

The costæ in the *upper* valve of our shell are visible in most of the specimens found at Woolwich; these may also be observed in some from Beauvais, although in the generality of specimens from this latter locality they are obsolete. Tab. VII, fig. 3, *b*, has the upper valve quite free from these radiations, while in Tab. VII, fig. 3, *c*, another specimen from the same locality, they are very distinct. Differences quite as great, or even greater, may be observed in specimens of *O. edulis*. M. Hebert considers the shell from Kleyn-Spauwen, figured under this name, to be a different species, and says (Bull. de la Soc. Géol., 1848-9, p. 469, No. 7) that he has examined only the upper valve, and that this presents sufficient differences to entitle it to be specifically removed from *Bellovacina;* having seen only one valve, he refrains from giving it a new name. The shell represented by M. Nyst has distinct radiations upon the upper valve, but the muscle-mark seems rather more rounded than in the British fossil, which is reniform and somewhat pointed; the same may be said of the figure of the muscle-mark given by M. Deshayes from the Paris Basin; in a specimen I have from Beauvais, the muscle-mark precisely resembles those in the Woolwich specimens. I believe them to be the same species.

Philippi introduces this name as a fossil from Palermo, but he gives no figure, only a description, and this so short that it might be adapted to other species. In the Museum of the Geological Society is a specimen from Gibraltar much resembling our shell, but I think it is distinct; it has rather larger radiations, and these are more foliaceous. Sir Charles Lyell gives the name of *Bellovacina* to an Ostrea found in limestone at the "Grove," about seventeen miles north of Charleston, in South Carolina, 'Proc. Geol. Soc. Lond.,' February, 1845, p. 567, and I have seen a specimen, in Sir Charles's cabinet, from Virginia (without a name), which, in some characters, resembles *O. pulchra*: I can scarcely think it strictly identical either with it or with *Bellovacina*.

4. Ostrea callifera, *Lamarck*. Tab. V, fig. 1, *a*, *b*.

Ostrea callifera.			*Lam.* Hist. des An. sans Vert., t. vi, p. 218, No. 19, 1822.
—	—		*Desh.* Coq. Foss. des Env. de Par., t. 1, p. 399, pl. 50, fig. 1; and pl. 51, figs. 1, 2, 1824—37.
—	—		*Id.* An. sans Vert. du Bassin de Par., t. 1, p. 110, 1860.
—	—		*Goldf.* Pet. Germ., vol. ii, p. 27, No. 71, pl. 83, fig. 2, *d—f*, 1833.
—	—	?	*Nyst.* Coq. Foss. de Belg., p. 317, pl. 29, fig. 1, *a*, 1843.
—	—		*Bronn.* Lethæa Geogn., t. 39, fig. 14, 1836.
—	—		*Forbes.* Mem. Geol. Surv., 1856, pp. 46—145, pl. 1, figs. 5, 5, *a*.
—	hippopus?		*Lam.* Loc. cit. sup., t. viii, p. 159, No. 2, 1806 (non *hippopus recens*).

Spec. Char. O. testâ ovatâ, hinc prope basim callo crasso subauritâ; valvâ majore

crassissimâ, intùs irregulariter excavatâ; extùs lamellosâ, valvâ superiore planâ vel concavâ; apice ad sinistram? arcuato; areâ ligamenti latâ.

Shell ovate, with a projecting callosity on the opposite side to the curved umbo; shell thick, irregularly excavated; externally lamellated; upper valve flat.

Dimensions, 4 inches by 3.

Localities. Hempstead, Isle of Wight (*Forbes*).
Belgium, Pietrebais, près de Chapelle St. Laurent (*Nyst*).
France, Roquencourt, le parc de Versailles (*Desh.*)

This species, so far as I know, is in England confined to the upper beds of the older Tertiaries called the Hempstead series, and there it does not appear to be abundant. Its peculiar character is the callosity on the left or lower valve, caused by the broad adherence of the animal inclining to one side; this habit is retained until it is considerably advanced in age. The shell is thick and heavy; the umbo of Mr. Edwards's specimen (fig. 1, *b*) curves towards the siphonilateral margin, while the specimen from Jermyn Street (fig. 1, *a*) has the umbo in the opposite direction. This depends upon the mode of attachment in the young state, the umbo having been deflected by an impediment. The outer surface of the lower valve is irregularly rugose and coarsely laminated; the upper valve is much thinner than the lower, and flat, with the laminæ finer and closer.

An oyster from the Nummulitic Formation at Cutch is figured and described under the name *O. callifera* by Mr. Jas. Sowerby, 'Trans. Geol. Soc.,' vol. v, pt. 2, second series, pl. xxv, fig. 16. The Cutch specimen, which I have examined in the Museum of the Geological Society, does not, I think, belong to this species, and M. D'Orbigny, in his 'Prod.,' has named the shell *O. Sowerbyana*.

The upper valve of an oyster from Uffhofen in the Museum of the Geological Society is marked with this name, but it would be difficult to determine a species from that valve alone; the specimen is peculiar in being excessively thick, and it is perforated in the centre by the entire abstraction of the shell where the adductor muscle was attached.

M. D'Archiac gives this species somewhat doubtingly from the Nummulitic Beds in the environs of Bayonne.

5. Ostrea cyathula? *Lamarck.* Tab. VII, fig. 7, and Tab. VIII, fig. 3.

Ostrea cyathula.	*Lam.*	Ann. du Mus., t. viii, p. 163, No. 12, 1806.
—	—	*Desh.* Coq. Foss. des Env. de Par., t. 1, p. 369, pl. 54, figs. 1, 2; and pl. 61, figs. 1—4.
—	—	*Id.* An. s. Vert. du bassin de Par., t. ii, p. 114, 1860.

Spec. Char. O. "*testâ ovato-rotundatâ, profundâ, incrassatâ, solidâ; umbonibus magnis, posticè inflexis, aliquando contortis; valvâ majore subtùs plicatâ, plicis angustis, distantibus, radiantibus, lamellis transversis interruptis; valvâ superiore planâ, transversim striato-lamellosâ, supernè crassâ: impressione musculari semi-ovatâ, transversâ; fossula cardinali superficiali, transversim striatâ.*"

Diameter, 1½ inch.

Locality. Stubbington (*Edwards*).

In the beautiful work above referred to, now in course of publication by M. Deshayes, the author gives not less than three varieties of this species, and the British fossil does not differ in essential characters from one of the varieties of what is considered by the French author to be a very variable shell. I have, however, placed the British fossil under that name with a mark of doubt.

6. Ostrea cymbulöides, *S. Wood*. Tab. III, fig. 2, *a*, *b*.

Spec. Char. O. testâ ovato-oblongâ, depressiusculâ, valvâ inferiore radiatim plicatâ, plicis rotundis, tuberculato-squamosis, subundulatis, bifidis; valvâ superiore planâ; marginibus supernè crenatis.

Shell ovately oblong, slightly depressed; inferior valve radiately plicated, with rounded, rough, or tuberculated and bifurcated rays; margin crenulated all round in the lower valve, with lateral crenations on the upper part of the flat valve.

Longest Diameter, 1½ inch.

Locality. Herne Bay (*Bowerbank*).

Although this shell bears considerable resemblance to some of the forms of *cymbula*, it cannot satisfactorily be referred to that species, being more regularly ovate in outline, and more finely costated. It differs from *flabellula* in several characters, and it does not appear to have the tendency to angularity or prolongation which that species exhibits; it has also more numerous rays. *O. divaricata*, Lea, somewhat resembles this species, but that shell is more inflated on what, in the Dimyaria, would be the siphonal region, and there is also, apparently, a difference in the form of the muscle-mark; this in our shell is large, reniform, and somewhat pointed upwards, while in the American fossil it is semi-lunate.

The British fossil appears to be rare.

7. Ostrea dorsata, *Deshayes*. Tab. VI, fig. 2.

Ostrea dorsata.	*Desh.* Coq. Foss. des Env. de Par., vol. i, p. 355, No. 22, pl. 55, figs. 9—11; and pl. 64, figs. 1—4, var. β; pl. 54, figs. 9, 10.
—	—	*Id.* 2d edit., Lam., t. vii, p. 251, No. 42, 1836.
—	—	*J. Sowerby*. Min. Conch., t. 489, fig. 2.
—	—	*Id.*, in Dixon, Geol. of Sussex, p. 174, 1850.
—	—	*D'Orbigny*. Prod. de Palæont., t. 11, p. 395, No. 1139, 1850.
—	—	*Morris*. Catal. Brit. Foss., p. 174, 1854.
—	—	*Desh.* An. sans Vert. du Bassin de Par., t. 11, p. 102, 1860.

Spec. Char. O. testâ orbiculatâ, utrinque gibbosâ; in medio plus minusve subangulatâ, vel semicylindraceâ; valvâ inferiore convexâ, extùs irregulariter lamellosâ; valvâ superiore striatâ; striis tenuibus, divaricatis, instructâ; marginibus supernè crenulatis.

Shell suborbicular; lower valve convex, and irregularly laminated; upper valve ornamented with fine, longitudinal, and divaricating striæ; margin of the valve crenulated above on each side of the hinge.

Dimensions, 5 inches by 4.

Localities. Bracklesham (*Edwards*).

France, Valmondois et Senlis (*Deshayes*).

This species is not abundant, and it is confined, I believe, to Bracklesham. The peculiarity of this shell, whence I presume it received its name, is the elevation of the centre of the upper valve. This arises from an adherence of the animal to some cylindrical body, by which a considerable indenture is given to the outside of the lower valve and an elevated ridge to the inside; this is communicated to the upper valve, in order to give room to the animal inhabitant, and thus an elevated, semi-cylindrical ridge is on the outside of the upper valve, corresponding with the body adhered to. Specimens sometimes occur which have been attached by the greater portion of the lower valve to a flat surface, and the upper valve in this case has no elevation, but its favorite habit was apparently to select a cylindrical stem for support. The upper valve is covered with fine striæ, and the interior has the margins crenulated near the hinge; but M. Deshayes figures a specimen (pl. 64, fig. 3) in which the crenulations have extended round the entire margin of the upper valve. This is not so in the British specimens which have come under my inspection. The ligamental area is large and broad.

8. Ostrea elegans? *Deshayes.*

Ostrea elegans. *Desh.* Coq. Foss. des Env. de Par., p. 361, pl. 50, figs. 7—9.
— — *J. Sowerby*, in Dixon's Geol. of Sussex, p. 174, 1850.
— — *J. Morris.* Catal. Brit. Foss., p. 174, 1854.

"This is intermediate in several respects between *O. radiosa* and *O. flabellula*, but has more plaits than the latter. I much doubt the propriety of separating it as a species."—*J. Sowerby.*

I am inclined to think with Mr. Sowerby that the English fossil called *elegans* is only a variety. There is not any fossil in Mr. Edwards's collection that deserves to be called *elegans*, in specific contradistinction to *radiosa*, Sow., *flabellula*, or *cymbula*; and as the above name is given upon the authority of Mr. Edwards's specimens, it is introduced here without a figure, and with considerable doubt.

9. Ostrea flabellula, *Lamarck.* Tab. III, fig. 4, *a—d.*

Chama plicata. *Solander*, in Brander, Foss. Hant., pl. viii, figs. 84, 85, 1766.
Ostrea flabellula. *Lam.* Ann. du Mus., t. viii, p. 164, No. 16; and t. xiv, pl. 20, fig. 3, *a*, *b*, 1806.

Ostrea flabellula.	*J. Sowerby.*	Min. Conch., t. 253, 1819.
— —	*? Basterot.*	Coq. Foss. des Env. de Bord., p. 72, 1825.
— —	*Deshayes.*	Coq. Foss. des Env. de Par., p. 366, pl. 63, figs. 5—7, 1825.
— —	*Goldfuss.*	Petr. Germ., t. 11, p. 14, No. 33, pl. 76, fig. 6, *a—g*.
— —	*Galeotti.*	Mém. de l'Acad. de Brux., t. xii, pl. iv, fig. 6, *a, b*, 1837.
— —	*Nyst.*	Coq. Foss. Belg., p. 323, pl. 29, fig. 3, *a, a', b, b'*, 1843.
— —	*Bronn.*	Leth. Geogn., B. iii, p. 352, t. 39, fig. 15, *a—c*, 1848.
— —	*J. Sowerby,*	in Dixon's Geol. of Sussex, p. 95, pl. 4, fig. 5, 1850.
— —	*Deshayes.*	An. sans Vert. du Bassin de Par., p. 120, 1860.
— deformis.	*Id.*	Coq. Foss. des Env. de Par., t. i, p. 346, pl. 55, figs 7, 8.
— subplicata.	*Id.*	- - - - p. 345, pl. 48, fig. 3.
— bifrons.	*Id.*	2d edit. Lam., t. vii, p. 242, 1836.

Spec. Char. O. testâ cuneatâ vel ovato-orbiculari; valvâ inferiore plicatâ, plicis radiantibus, rugosis, arcuatis, hinc indè furcatis; valvâ superiore planâ concentricè striatâ; intùs lævi vel obsoletè ad marginem denticulatâ.

Shell wedge-shaped or ovately orbicular; lower valve plicated or ribbed; ribs rugose, radiating, and bifurcating in the older shell; upper valve flat, concentrically striated, with the inner margin finely or obsoletely denticulated.

Longest diameter, 1½ inch.

Localities. Barton, Bracklesham, Bramshaw, Clarendon, Southampton, Stubbington, Whitecliffe Bay (*Edwards*), Bagshot, Clewett's Green, Headley on the Hill, Orpington, Sundridge, (*Prestwich*).

France, Grignon, Parnes, Courtagnon (*Desh.*), Bayonne (*D'Archiac*).

Belg., Le sables d'Uccle, de St. Gilles, de Foret, de Lacken, &c. (*Nyst*).

The two specimens from Barton, figured in Brander, Nos. 84 and 85, pl. vii, are considered by some authors to belong to two distinct species, viz., *O. flabellula* and *O. cymbula.*

In Mr. Edwards's cabinet is a group of these shells from Barton, adhering to each other, one of which possesses the ovate form of *cymbula,* while another has the cuneate or typical form of *Ch. plicata,* Br., 85; and I cannot imagine that they were otherwise than the offspring of the same parent, and I believe that the two shells figured in Brander belong to the same species. Groups of these varying forms are not uncommon also at Bracklesham.

The English specimens vary much in outline, some being cuneiform or triangular, while others are oval: this difference does not appear to be the result of impediment to the natural growth, and it is principally by the outward form that the specific distinction has been made, the angular one constituting *flabellula,* and the ovate one *cymbula.* Sometimes this species adheres broadly and firmly to some foreign body, and a large space is left upon the shell denoting the place of adherence, while in other specimens there is scarcely the

slightest mark of attachment. When it adheres to a cylindrical stem the shell is much elevated, and the form of the body is communicated to the upper valve, giving it a ridge, like that found in specimens of *O. dorsata*. In thick individuals the ligamental area of the lower valve is much elongated, while in thinner shells this space is very short. The upper valve is plain, never radiated, but has merely concentric lines of growth: sometimes it is slightly convex, while at others it is irregularly concave or with a depression in the centre of the shell; it is also sometimes strongly denticulated on each side of the hinge-area; in one specimen I counted as many as twenty, in others there are scarcely any. The lower valve also possesses these denticulations more or less, but their number is no guide in specific determination.

A fossil from the Nummulitic Formation of Cutch has been figured and described under this name in the 'Geol. Tr.,' vol. v, pl. xxv, fig. 18, specimens of which are in the Museum of the Geological Society.

O. angulata, fig. 17, on the same plate, comes even nearer in form to *flabellula*; it is possible that they may both be the same as the British species, which was very variable, and had an extensive range. The specimen, Tab. VIII, fig. 5, *a*, *b*, is from Clarendon, and although it presents differences, I have regarded it as a dwarf variety (*modicella*), from its general resemblance to the typical form. In this shell there is very great inequality in the two valves.

A specimen of the lower valve of this species has been met with in the Red Crag, at Sutton, and in good condition. It is therefore probable that the bed which originally contained it, and out of which it was derived, was not very remote from where it was found.

This species is so generally known as a British fossil under the above Lamarckian name, that I do not feel disposed to change it, although it ought to be called by Solander's name, *plicata*.

10. Ostrea gigantea, *J. Sowerby*. Pl. II.

Ostrea	gigantea.		*J. Sow.* Min. Conch., t. 64, 1814.
—	—	?	*Rousseau.* Voy. dans la Russie Méridionale, vol. ii, pl. 4, fig. 1.
—	—	?	*Leymerie.* Mém. de la Soc. Géol. de Fr., 2d ser., vol. i, pl. 17, fig. 2.
—	—	?	*Baily.* Foss. Inv., from the Crim. Quart. Jour. Geol. Soc., vol. xiv, p. 143, 1858.
—	latissima.		*Desh.* Coq. Foss. des Env. de Par., t. i, p. 336, pl. 52 and 53.
—	—		*Galeotti.* Mém. Cour. par l'Acad. de Brux., t. xii, p. 151, pl. 4, fig. 18, 1837.
—	—	?	*De Verneuil* and *Desh.* Mém. sur la Crimée, Mém. de la Soc. Géol. de Fr., t. iii, pt. 1, p. 19, pl. 4, figs. 1—3, 1838
—	Pyrenaica?		*D'Orbigny.* Prod. de Palæont., t. ii, p. 317, No. 548, 1850.
—	gigantica.		*Solander*, in Brand., Foss. Hanton., p. 36, No. 88, pl. 8, fig. 88, 1776.
—	—		*Nyst.* Coq. Foss. de Belg., p. 314, pl. 27, fig. 1 *b*; pl. 28, fig. 1*a*, 1843.
—	—		*Desh.* An. sans Vert. du Bassin de Par., t. i, p. 108, 1860.

Spec. Char. O. testâ magnâ, crassissimâ, ovato-circulari, inæquivalvi, irregulariter lamellosâ; valvâ inferiore gibbosâ, convexâ; valvâ superiore planâ, impressione musculari sublunari, profundâ; umbonibus brevibus; cardine plano-triangulari, striato, foveolâ profundâ; marginibus supernè rugoso-plicatis.

Shell large and thick, ovately circular, inequivalved, irregularly lamellated; inferior valve gibbous and convex; upper valve flat; muscle-mark gibbosely lunate; beaks short, hinge area flattened and triangular, deeply marked with lines of growth; rugosely plicated on each side of the hinge.

Diameter, 6 inches.

Localities. Bognor, Barton (*Edwards*), Cuffell near Basingstoke (*Prestwich*).

Belgium, Kleyn Spauwen; Piétrebais, près de Chapelle St. Laurent (*Nyst*); Middle Limburg (*Lyell*).

France, Chaumont, Valmondois (*Deshayes*).

M. Brown (Leth. Geogn., b. 11, p. 355) has considered the fossil found in the Crimea, called *gigantea* by MM. De Verneuil and Deshayes, as a distinct species, to which he has given the name of *O. Pyrenaica*; and he is not alone in this opinion. If the figure by M. Deshayes represents its constant character, the muscle-mark appears to be not only of a different form, but to be situated nearer to the hinge than in our specimens. Form, in this genus, is of itself a character by no means to be depended upon, as the shell is frequently distorted.

Fig. 6, Tab. VIII, appears to me to possess the characters required for a place in this species. The principal difference is in the shape; the lengthened beak, and elevated muscle-mark, are consequent upon its peculiar form; but the cicatrice is of a different colour from the shell, as is usual in *gigantea*. The rugosities, or denticulations, at the shoulders which distinguish this species are not very evident, although there are traces of them, and they are perhaps destroyed.

Mr. Sowerby, in Dixon's 'Geology of Sussex,' pp. 95 and 173, introduces an oyster under the specific name *elephantopus*; and, after giving a full description, but no figure, says, "This differs from *gigantea* in the form of the hinge-pit, which is considerably elevated in that species, and in the depth of the hollow valve. It shows the same cellular tissue as *O. cariosa* of the Bognor Rock, which may possibly be the young of the same species, although such large specimens have not been found at that place."

The specimen to which the name *elephantopus* is attached in the late Mr. Dixon's collection in the British Museum is an upper or right valve of great solidity; but it does not appear to me to offer any character that will separate it from *gigantea*, to which I believe it belongs. The peculiarity of the hinge in extending inwards is the result of the excessive thickening of the shell, by the successive layers of calcareous matter over the entire surface of the interior. Similar specimens are in the cabinets of Mr. Edwards and Dr. Bowerbank, and I am unable to detect any other difference than that which has been produced by age. These shells possess the same peculiar structure, as is so strikingly displayed in some

specimens of the upper valve of *gigantea*, from Barton. This structure is not, in general, so evident in the lower or left valve, where the exterior generally appears foliaceous; but the carious structure may be observed, where there is a fracture.* The Barton specimens appear to have adhered broadly. Dr. Bowerbank's specimen, from Bracklesham, exhibits scarcely any mark of attachment. One of my specimens, from Barton, had been fixed to a cylindrical body, which has imparted to the upper valve a semi-cylindrical elevation like that characteristic of *dorsata*, which it much resembles; and the outer surface, where it is preserved, is covered with fine radiating striæ, which are occasionally in ridges, like those represented upon *O. oblonga*, Brander, Pl. VII, fig. 83. I suspect that this last specimen was only an imperfect individual of the present species. There is a great tendency to thickening of the shell in those from Bracklesham. One aged specimen in Dr. Bowerbank's museum has the following dimensions:—diameter, 5 inches by 4, *thickness of shell* in this lower valve, two inches and four tenths. *O. callifera* (from Cutch), J. Sowerby (Tran. Geol. Soc., vol. v, pl. ii, second series, pl. xxv, fig. xvi), is a shell in that state, probably belonging to this species.

Ostrea cariosa is given by Professor Morris, in his catalogue, as a British fossil; and it is also introduced by Mr. J. D. C. Sowerby, in Dixon's 'Geology of Sussex,' pp. 117, 226; I have not seen a specimen on which this specific isolation might be founded. May it not be the young state of *gigantea?* as suggested by Mr. Sowerby.

11. Ostrea gryphovicina, *S. Wood.* Tab. VII, fig. 6, *a*, *b*.

Spec. Char. O. testâ crassâ, ovatâ; valvâ inferiore tumidâ, profundâ, obsoletè lamellatâ; valvâ superiore planiusculâ, nudâ; cardine magno, trigono, fossulâ ligamenti angustissimâ, excavatâ; marginibus integris; impressione musculari subrotundâ, parvâ.

Shell thick, ovate; lower valve tumid and deep, with almost obliterated lamellæ; upper valve flattened and nearly smooth; hinge area broad, with a long, narrow, and deep ligamental furrow; margins free from crenulations; muscular impression round and small.

Height, 2½ inches.

Localities. Sheppey (*Bowerbank*), Hampstead (*Wetherell*).

The peculiarly deep, contracted, and elongated ligamental pit in these shells differs from any other that I have seen, and gives reason to believe that they belong to a distinct species; the shape of the muscle-mark appears also to be different from any other. In the specimen belonging to Mr. Wetherell there is an obtuse lateral lobe separated by a shallow sinus

* On requesting Dr. Carpenter to give me his opinion upon this peculiar appearance, he says:—"I think it likely that the structure you allude to is one which I have seen in various large oysters, both recent and fossil, and which was first noticed, I believe, by Dr. J. E. Gray, namely, a cancellated tissue filling up the space that would otherwise be left empty between separated lamellæ."

on the siphonal region, like the character generally given for *Gryphæa*, and on the tablet of Dr. Bowerbank's specimen was written the name of *Gryphæa*; I cannot see anything to distinguish it generically from *Ostrea*, except the very small place of attachment, which of itself is insufficient.

12. Ostrea inflata? *Deshayes.* Tab. VII, fig. 4.

Ostrea inflata.	*Desh.*	Coq. Foss. de Par., t. i, p. 359, pl. 58, figs. 4, 5, and pl. 59, figs. 1, 2, 1825.
—	—	*J. Sow.*, in Dixon's Geol. of Suss., p. 95, t. iv, fig. 7, 1850.
—	—	*Morris*, Catal. Brit. Foss., p. 174, 1854.

Spec. Char. "*O. testâ ovato-deformi, profundâ, gibbosâ; valvâ inferiore rariplicatâ; umbone angusto; fossulâ ligamenti angustâ, marginibus supernè crenatis.*"

Shell deformedly ovate, deep, inflated (?), lower valve with few radiating ridges, umbones sharp, ligamental area narrow, superior margins crenulated.

Longest Diameter, $1\frac{1}{2}$ inch.

Localities. Bracklesham (*Edwards*).

France, Valmondois (*Deshayes*).

This is not at all a satisfactory species. I have only two or three specimens from Mr. Edwards's cabinet that appear to correspond with the above diagnosis of M. Deshayes. They are left valves, and have adhered, near the margin of the shell, to some cylindrical body; they are by no means "inflated," but shallow. The shell figured by M. Nyst, under this name, appears to be very different from the British specimens.

13. Ostrea longirostris, *Lamarck.* Tab. VI, fig. 4.

Ostrea longirostris.	*Lam.*	An. du Mus., t. 14, pl. 21, fig. 9.
—	—	*Desh.* Coq. Foss. de Par., t. i, p. 351, pl. 54, figs. 7, 8; pl. 60, figs. 1—3; pl. 61, figs. 8, 9; pl. 62, figs. 4, 5; and pl. 63, fig. 1.
—	—	*J. Sow.*, in Dixon's Geol. of Sussex, p. 174, t. iv, fig. 4, 1850.
—	—	*Morris.* Catal. Brit. Foss., p. 175, 1854.
—	—	*Desh.* Hist. des An. sans Vert. du Bass. de Par., t. ii, p. 110, 1860.

Spec. Char. O. testâ diversiformi, ovato-rotundatâ, vel elongato-irregulari; foliaceâ, rugosâ, incrassatâ; striis lamellosis transversis instructâ; valvâ inferiore profundâ; umbone longissimo, canaliculato, irregulariter contorto, acuto, trigono, tenuè-striato vel sulcato; fossulâ utroque latere marginatâ.

Shell variable, ovately rounded, or elongately irregular, foliaceous, rough, and very thick: inferior valve deep, with a very elongated ligamental area strongly marked with transverse striæ or lines of growth.

Dimensions, 4 inches by 2.

Localities. Hempstead (*Edwards*), Bracklesham (*Dixon*).
France, Montmartre, Sceaux, Longjumeau (*Deshayes*).

There are two or three species in this genus which have an extended ligamental area, and are equally deserving of the present or a similar appellation.* The fossil oyster from Lisbon has the hinge area as long as that of the Eocene species, and it has also been called *longirostris,* but the shape of the shell is very different. The recent American oyster *O. Virginica* (*O. crassa,* 'Chemn.,' vol. viii, p. 40, t. 74, f. 678), has a similar character, but is, I think, distinct.

The present species does not appear to have been abundant in the British Eocene Seas, and I have not seen the upper valve; M. Deshayes speaks of the French shell as by no means rare, and he gives four distinct varieties of his species. Philippi ('En. Moll. Sic.,' vol. ii, p. 64) introduces *O. longirostris* as a fossil from Syracuse, but he does not give a figure; he quotes Goldfuss, as well as Deshayes.

14. Ostrea marginidentata, *S. Wood.* Tab. V, fig. 2, *a—d.*

Ostrea radiosa. *J. Sow.*, in Dixon's Geol. of Sussex, p. 174, 1850.
— — *Morris.* Catal. Brit. Foss., p. 175, 1854.

Spec. Char. O. testâ ovatâ vel orbiculatâ, crassâ; valvâ inferiore plicatâ, plicis squamosis, radiantibus; valvâ superiore planâ; marginibus valdè crenulatis vel denticulatis; impressione musculari magnâ.

Shell ovate or orbicular, thick, and strong; lower valve plicated, with radiating and rough ridges or ribs; upper valve flat and plain, margin crenulated, muscular impression large and slightly curved or reniform.

Diameter, $3\frac{1}{2}$ inches.

Locality. Bracklesham (*Edwards.*)

This is by no means rare. Among Mr. Edwards' specimens there is great variation. Fig. 2, *d,* resembles the form and most of the characters of *O. extensa,* as given by M. Deshayes. Many specimens from Bracklesham have adhered by a large surface, extending over nearly the whole valve; in these cases the interior is shallow, and the shell is more orbicular; when the adherence is by a small portion of the surface or by the beak only, the valves are then more elevated and deeper. I have given a view of the interior of both valves, to show the difference in form of the adductor muscle-mark. In the specimen, fig. 2, *a,* the animal has extended the shell into a sort of shoulder; and the adductor muscle has followed the course taken by the mantle; from this distortion the muscle-mark is much altered.

* I have retained the name of *longirostris* for this species, as it is presumed to be identical with the Paris Basin shell, which was the one originally so called.

This fossil has been hitherto assigned to *O. radiosa*, Desh., and I feel reluctant to alter the name; but the large denticulations which are found invariably, in a greater or less degree, on the inner margin of the upper valve in well-preserved specimens, appear to offer a good specific character in contradistinction to the French shell of that name.

15. Ostrea multicostata? *Deshayes.* Tab. VI, fig. 3, *a*, *b*.

Ostrea multicostata. *Desh.* Coq. Foss. des Env. de Par., p. 363, pl. 57, fig. 3—6.
— — *Bronn.* Leth. Geogn., b. iii, p. 352, t. 36², fig. 6, *a*, *c*.
— — ? *D'Archiac.* Anim. Foss. numm. de l'Inde, p. 273, pl. 24, 1854.

Spec. Char. O. testâ ovato-elongatâ, subrectâ, supernè acutâ; valvâ inferiore costatâ, costis divergentibus; valvâ superiore planulatâ, lamellis tenuibus, concentricis, ornatâ; impressione musculari obliquâ.

Shell ovately elongate, somewhat straight, with an acute umbo; lower valve covered with diverging ribs which bifurcate on the outer or older portion of the shell; upper valve flat, with small or fine concentric laminæ or lines of growth; muscular impression oblique.

Height, 3 inches.

Locality. Bracklesham (*Edwards*).
France, Retheuil (*Desh.*).

A specimen in Mr. Edwards' collection corresponds with the figure and description by M. Deshayes above referred to, and I have therefore regarded it as an identity, although it is possible it may only be an enlarged growth of one of the Bracklesham varieties of *flabellula*. This is said to be abundant in France, where I presume there are better means of determining the species. The umbo in our shell is sharp and pointed, and the place of attachment is very small. The upper valve is plain, or without the least appearance of radiating striæ. The muscle-mark is of a somewhat transversely ovate form, *excentric*, and appears rather smaller, comparatively, than the one represented by M. Deshayes; the ribs in our shell are smoother or less scaly; these trifling differences would probably disappear in a large series.

16. Ostrea picta, *J. Sowerby.* Tab. VII, fig. 2.

Ostrea picta. *J. Sow.*, in Dixon's Geol. of Suss., pp. 95, 173, t. iv, fig. 1, 1850.
— — *Morris.* Catal. Brit. Foss., p. 175, 1854.

Spec. Char. O. testâ crassâ, orbiculari, intùs purpureo-nigricante, lamellis vix distinctis: valvâ inferiore profundâ, valvâ superiore planatâ; areâ cardinali latâ: impressione musculari magnâ, suborbiculari.

Shell thick, orbicular, uneven, not imbricated; lower valve deep, upper valve nearly flat; hinge area broad and flat, muscular impression large and orbicular; both valves coloured within.

Diameter, $3\frac{1}{2}$ inches.

Locality. Bracklesham (*Dixon*).

"Colour is so rare an occurrence among oysters, and especially among fossils, that we are glad to accept it for a specific mark. The present shell belongs to a section of the genus which contains species whose surfaces are not imbricated, but covered by a continuous plate of a fibrous structure; in this the structure is, however, obscure; in *O. tabulata* and *O. dorsata*, &c., it is very easily detected. Old shells seem to be imbricated because the edges of the laminæ are worn away. The surface of the young shell, well shown in an individual which has been attached to a large *Nautilus*, is nearly smooth, but irregularly marked with distant, short, interrupted striæ: the hinge area projects into the cavity of the shell."—*Sowerby.*

This species is rare, and colour appears to be its most distinguishing character. The upper valve exhibits some depressed, broad, irregular, and rather obscure radiations, separated by a small depressed line and coloured rays; the lower valve shows a broad mark of attachment; and the shell is somewhat compact, with fine lines of growth and small or incipient lamellæ, but it is less laminated than *gigantea*, which it otherwise much resembles; the muscle-mark is transversely rounded, and of the form usually assumed in the orbicular oysters.

17. Ostrea prona, *S. Wood.* Tab. III, fig. 3, *a*, *b*.

Spec. Char. O. testâ crassâ, obliquâ, cuneatâ; valvâ inferiore tumidâ, inflatâ, profundè plicatâ, plicis radiantibus hinc indè furcatis, elevatis, angulatis; valvâ superiore planatâ; cardine introrsum recurvo.

Shell thick, strong, oblique, and wedge-shaped; lower valve tumid, inflated, and deeply plicated; folds radiating, elevated, angulated, and bifurcated; upper valve flat, plain; umbo inflexed.

Diameter, $2\frac{3}{4}$ inches.

Localities. Brockenhurst, Lyndhurst (*Edwards*).

This shell is by no means rare in Mr. Edwards' cabinet. The young of this species strongly resembles *O. flabellula*, and like other species in several genera, the immature shell can scarcely be distinguished from some proximate species of less magnitude. I think, however, there is sufficient difference in the full-grown individual to justify its specific separation. The ribs or folds in this species are perfectly angular in well-preserved specimens, while in *flabellula* they are obtuse or rounded; this difference is its principal distinction.

An oyster from Kleyn Spauwen was obligingly sent to me some years ago by the Comte du Chastel, but without a name. The specimen is, I believe, identical with the Brockenhurst shell; it resembles it even in colour.

18. Ostrea pulchra, *J. Sowerby*. Tab. I.

Ostrea pulchra. *J. Sow.* Min. Conch., t. 279.
— — *Morris.* Catal. Brit. Foss., p. 175, 1854.

Spec. Char. O. testâ magnâ, orbiculato-ovatâ, crassâ, depressâ; valvâ inferiore convexâ, lamellatâ, in juventute plicatâ vel costatâ; valvâ superiore planatâ; cardine brevissimâ; impressione musculari ovato.

Shell large, roundly ovate, thick, depressed; lower valve convex, lamellated, and plicated or costated in the young state; upper valve plain and flat, hinge very short; muscular impression ovate.

Diameter, 7 inches.

Localities. Reading, Clarendon (*Edwards*).

Small var. Bromley, Tyler's Hill near Chesham, Old Basing (*Prestwich*).

This species differs from *O. Bellovacina* in being more numerously rayed or costated in the lower valve of the young shell; these ridges become nearly obsolete as it advances in age, and the upper valve is naked, or free from radiating ridges. The Reading specimens are generally orbicular, those from Clarendon have the greatest diameter from the umbo to the ventral margin.

In the Reading specimens many have the two valves united, and the ligament preserved; the small shell figured Tab. IV, fig. 2, *a*, *b*, is the representation of what I imagine to be the young state of the upper or right valve of this species from Clarendon; the umbo is much recurved or inflected after the manner of *Gryphæa* or *Exogyra*, and on each side of the hinge the margin is crenulated or denticulated; this character may be seen in some of the large and full-grown specimens of this species from Clarendon. Mr. Edwards' specimen of this species from Reading measures seven inches and a half in the longest diameter, and I think the animal inhabitant must have attained to the dimensions of at least six inches, with a depth of rather more than one inch. The shell figured in 'Min. Conch.' from Bromley, above referred to, represents what I believe to be a small variety of this species, and the same kind is also found at Sunning Hill.

19. Ostrea tabulata, *J. Sowerby*. Tab. IV, fig. 1, *a*, *b*.

Ostrea tabulata. *J. Sow.*, in Dixon's Foss. of Suss., pp. 117, 226, 1850.
— — *Morris*, Catal. Brit. Foss., p. 175, 1854.

Spec. Char. Testâ orbiculatâ, depressâ; lævigatâ; valvâ inferiore imbricatâ obscurè radiatâ; valvâ superiore planâ, nitidâ, politâ; umbonibus parvis.

"Shell orbicular, depressed, smooth; upper valve slightly concave, even, its plates few, with distant, scarcely raised edges; lower valve obscurely marked by radiating undulations, its plates few, in groups, with remote, deeply imbricating edges; beaks small, pointed: muscular impression ovate, curved, of a moderate size."—*Sowerby*.

Diameter, 7 inches,

Locality. Bognor.

This is an abundant shell at Bognor, to which locality it appears to be restricted.

Mr. Sowerby remarks "that it was evidently a rapid growing shell; its nearly smooth external laminæ extend far between each period of growth, and show their fibrous structure distinctly, especially upon the surface." The specimens generally have adhered only in the young state by a very small portion of the surface, and are solitary. I have rarely seen them in groups. A specimen in Mr. Wetherell's cabinet shows the muscle-mark to be rather elongate, and more curved than is the rounded form of this mark in *gigantea*. The lower valve in the young state is obscurely rayed, and the upper is generally glossy, and the shell is flatter or more compressed than that of *gigantea*.

20. Ostrea tenera, *J. Sowerby*. Tab. VI, fig. 1, *a*, *b*.

Ostrea tener. *J. Sow.* Min. Conch., t. 252, figs. 2, 3, 1819.
— tenera. *Id.*, in Dixon's Foss. of Suss., p. 174, t. iv, figs. 2, 3, 1850.
— — *D'Orbigny*. Prod. de Palæont., t. ii, p. 307, No. 199, 1850.
— — *Morris*. Catal. Brit. Foss., p. 175, 1857.

Spec. Char. Testâ elongatâ, attenuatâ, angustâ, depressâ valvâ inferiore sub-planâ, transversim lamellosâ, valvâ superiore striatâ vel inornatâ; umbonibus longis attenuatis; fossulâ ligamenti angustâ.

Shell elongate, attenuated, depressed; lower valve very slightly convex and transversely lamellated; upper valve flat, striated, or plain; umbones attenuated, ligamental; area long and pointed.

Height, 4½ inches.

Localities. Woolwich, Sundridge Park, New Cross, smooth and thick var. (*Prestwich*).
Bracklesham, thin and striated var. (*Edwards*).

"The Woolwich type of this species is generally smooth; but I have reason to think that the fibrous striated coat is more easily decomposed than the other laminæ of the shell, and has been therefore generally destroyed. Such appears to have been the case often with the Bracklesham individuals; however, some of the latter, having the fibrous coat, are almost free from striæ, and others want them over more or less of the surface, which has induced me to consider the striated ones as only varieties of the others." (*Sowerby in Dixon.*)

In support of the above remark, I may observe, that some of Mr. Edwards' specimens from Bracklesham show the upper valve to be quite free from ornament; others are fully covered over with numerous fine striæ; and one specimen unites these two varieties, the younger half of the upper valve being covered with striæ, and the lower or older portion being quite plain; both parts are apparently without decortication.

O. angustata, Desh., in many characters strongly resembles this species; but it appears rather more attenuated in the hinge than any of our British specimens, although such a difference as this may be accidental. In the representation of the French shell are a few depressed and irregular ribs, and the shell is free from striæ, but there are vestiges of radiating plicæ or obsolete ribs in our species.

The full-grown specimens may be said to have proportions generally of about three to one, but a full-grown specimen in Mr. Edwards' cabinet is not more than two to one and a half. In the young state the shell is often nearly orbicular, becoming elevated as it increases in size. One of our specimens has a very pointed umbo, and this is somewhat recurved.

21. Ostrea Vectiensis, *Forbes MSS.* Tab. VII, fig. 5, *a*—*c*.

Ostrea Vectensis. *Morris.* Mem. Geol. Surv. pp. 68, 150, t. 3, fig. 9, 9 *a*, 9 *b*, 1856.
— — *Id.* Cat. Brit. Foss., p. 175, 1854.

Spec. Char. "*Testâ ovato-trigonâ, oblongâ, attenuatâ, sub-angustâ; arcâ cardinali fossulâ triangulari, latâ, recurvâ exaratâ; umbonibus obtusis; valvâ superiore lineis incrementi numerosis ornatâ; valvâ majore crassâ, extùs rugosâ.*"

An oblong and rather narrow shell, with the larger valve somewhat thick and externally rugose; the upper valve flat, thin, recurved at the umbo, and marked by numerous concentric lines of growth; ligamental area broad and triangular." (*Morris.*)

Longest diameter, 1½ inch.

Locality. "Sandy beds of the Bembridge series." (*Morris.*)

This species does not appear to be rare; several specimens are in the Museum in Jermyn-street.

The right valve has occasionally crenulations in the margin near the hinge; but s this valve is often quite free from them; the form of the shell is also exceedingly

variable. Fig. 5, *c*, resembles *O. Sparnacensis*, Desh. (pl. 64, figs. 5—8.) The hinge (which is peculiar) is very similar, although, if that figure be correct, the muscle-mark is not so elongated as in our species. Fig. 5, *b*, is, I imagine, the lower valve of a specimen belonging to this species, and its recurved umbo gives it the appearance of a *Gryphæa*. None of the specimens in Jermyn-street possessed, that I could see, the radiations spoken of by M. Deshayes as distinguishing *O. gryphina*; and there is no diagnosis or any remark by the late Professor E. Forbes, on whose authority that species is introduced (Mem. Geol. Survey., 1856, p. 88.) I am therefore unable to consider *Gryphina* as a British species.

22. Ostrea velata, *S. Wood.* Tab. VII, fig. 1, *a*, *b*.

Spec. Char. Testâ ovato-trigonâ, sub-obliquâ; areâ cardinali latâ, incurvâ; valvâ inferiore lamellatâ; lamellis subregularibus, fimbriosis; valvâ superiore planulatâ, striatâ; striis magnis, undulatis.

Shell ovately trigonal, somewhat oblique; cardinal area rather broad, incurved; inferior valve lamellated, the lamellæ in general regular, fimbriated, or projecting; upper valve flattened and striated, striæ large and undulating.

Diameter, 2 inches.

Localities. Colwell Bay (*Edwards*), Whitecliffe Bay (*Prestwich*).

This is rather a pretty looking shell, and does not appear at all rare. Its great peculiarity consists in being striated upon the upper valve. The striation in our specimens exists only in the outer coating of the upper valve; this coating is sometimes entirely removed, and is seldom seen except in patches. I thought at one time it might have belonged to *cochlearia*, and that the French specimens had lost this outer cuticle; but there are no "obscure plications" in the lower valve, which the French fossil is said to possess, but it is regularly lamellated or fimbriated. I have, therefore, with reluctance felt compelled to give it a new name. The upper valve of this species, much distorted, I found, many years ago, in the small patch of marine shells which intervenes between the fresh-water deposits on the Hampshire Coast, at Hordwell. *O. cochlear.* Poli, is a recent species, and is quite distinct. *O. cochlear.*, Nyst (p. 330, pl. 32, fig. 2), which he gives as a fossil from Hoesselt and Lethen, in the Limburg, appears from figure and description, to be different from any oyster that I have seen from the older Tertiaries of England. *Cochlearia* is a name attached to several specimens of *Ostrea* in the Museum in Jermyn-street; but these specimens appear to me to belong either to *Vectensis* or to this species. In the second part of 'Coq. Foss. des Env. de Paris,' t. 2, p. 114, the author considers his former species of *O. cochlearia* as a variety of *O. cyathula.*

23. Ostrea zonulata, *S. Wood.* Tab. X, fig. 4, *a—c.*

Spec. Char. O. testâ elongato-ovatâ, tenui, fragili, valvâ sinistrâ convexâ, profundâ, imbricatâ; imbricibus tenuibus, distantibus; valvâ dextrâ planâ, lamellatâ; cicatriculâ musculari minimâ, reniformi; areâ cardinali angustâ.

Shell elongately ovate, thin, and fragile; left or lower valve convex, deep; upper valve flat and lamellated, lamellæ or fimbriations thin and distant; muscular impression small; cardinal area narrow.

Longest diameter, $1\frac{1}{2}$ inch.

Locality. Hill Head, near Stubbington. (*Fisher.*)

The above shell has been recently obtained by the Rev. Osmond Fisher, who has kindly permitted me to have it figured.

It somewhat resembles *O. velata* in the regularity of the imbrications, but it differs in having these imbrications fewer in number, and they are broader, more thin, and delicate; besides which, the upper valve in this species is quite free from the striæ which form so marked a feature in the upper valve of *O. velata.*

Fig. 4, Tab. VIII, represents a specimen of the upper valve of an oyster, from the cabinet of Mr. Edwards, and found at Bracklesham. This was figured previous to the discovery of the above species, and it was then considered so closely to resemble the French Eocene fossil, *O. lamellaris*, Desh. (Coq. foss. des Env. de Paris, pl. 54, figs. 3, 4), as to deserve a representation, from a possible identity; but in the subsequent work by the same author (An. sans Vert. du Bassin de Paris, t. xi, p. 106), that shell is referred to *O. multistriata*, in which species the upper valve is represented as finely and closely striated. Our shell is quite free from striæ of any kind, and it does not appear to have been decorticated. I am now therefore inclined to refer it to the present species.

In the 'Quarterly Journ. of the Geol. Soc.,' 1854, p. 117, Mr. Prestwich speaks of an oyster as having been met with at Kyson (*O. Bellovacina ?*); but the specimen cannot be found. Mr. J. C. Moore obtained an oyster in an estuary deposit in the New Forest. 'Journ. Geol. Soc.,' vol. v, p. 316, 1849. This specimen also we have not been fortunate enough to find.

VULSELLA. *Humphries*, 1797.

Tellina (sp.) *Rumph.*, 1705.
Pinna (sp.) *Linn.* 1758.
Mya (sp.) *Id.*
Baphia (sp.) *Gevers*, 1787.
Ostrea (sp.) *Brug.*, 1789. *D'Orb.*, 1850.
Vulsella. *Lamk.*, 1799.
Dalacia? *Gray*, 1825.
Reniella. *Swains.*, 1840.

Gen. Char. Shell somewhat irregular, elongated, compressed, inequivalved, free; hinge with connexus external or ligamentous; umbones straight, remote, carless; one muscular impression in each valve, subcentral.

This is a genus containing but few species, either in the recent state or as fossil. Six recent species have been described, and these are confined to the Oriental seas.

Lamarck had placed this genus close to *Ostrea*, to which in many of its characters it bears a great resemblance; it is truly monomyarian, and the connexus is situated as in the oyster, between divergent beaks upon an inclined plane, opening the valves by contraction. Cuvier removed it from that position to one in proximity with *Malleus*; and some authors still consider it only as a section of, or sub-genus to, *Avicula*. Judging from the shell alone, in the absence of a knowledge of the animal, the differences are too conspicuous to be included in that genus, and it appears to me entitled to claim an isolation equal to many other generally admitted genera.

Shells bearing the above generic characters have been found in the Chalk.

1. Vulsella deperdita? *Lamarck.* Tab. IX, fig. 2, *a—c.*

Vulsella deperdita. *Lam.* Hist. des An. sans Vert., t. vi, p. 222, No. 7.
— — *Defrance.* Dict. des Sc. Nat., art. *Vulsella.*
— — *Desh.* Coq. Foss. des Env. de Par., p. 374, pl. 65, figs. 4—6.
— — *Id.* An. sans Vert. du Bass. de Par., t. 2, p. 51, 1860.
— — *? Grateloup.* Cat. des An. Foss. des Env. de Bord., p. 59, 1838.
— — *Morris.* Cat. of Brit. Foss., p. 182.
Ostrea deperdita. *D'Orb.* Prod. de Palæont., p. 394, 1850.

Spec. Char. Testâ ovato-oblongâ, angustâ, inæquivalvâ, sub-lingulatâ, sublævigatâ, supernè tumidiore, apice retusâ; fossulâ cardinali magnâ, obliquè incumbente, laterali, basi prominulâ; areâ cardinali sinuato; impressione musculari sub-laterali, elongato-ovatâ.

Shell ovately oblong, elevated, and somewhat tongue-shaped, depressed and inequivalved, tumid at the upper part, with very divergent umbones; shell subnacreous, irregularly smooth with conspicuous lines of growth and a sharp margin, base prominent and rather pointed; muscular impression elongated.

Longest diameter, 1½ inch.

Localities. Barton (*Edwards*).

France—Grignon, Chaumont, Mouchy, le Châtel (*Desh.*), Blaye, (*Gratel*).

The hinge-area in the British fossil has apparently a larger ligamental depression, and a smaller sinus than is represented in the French shell; but these differences would probably vanish on a comparison with specimens of the shells themselves. The connexus is somewhat on one side of the hinge-area, as if counteracting the action of the adductor muscle which is on the other. The left valve extends the ventral margin beyond the edge of the right, making the shell inequivalve, like the oyster.

The above name has been published for an English fossil, and, as I have not the means of disproving the identity, I have permitted it to remain with a mark of doubt. The shell, like most of the oyster tribe, has a tendency to great variation, and the muscle-mark partakes of the varying form of the shell. Since the above was written, I find the following observation by M. Deshayes, in 'Hist. des An. sans. Vert du bassin de Paris,' p. 51:—"L'espèce est citée dans le bassin de Londres par M. Morris; mais à Barton elle est accompagnée d'une autre très-distincte, beaucoup plus rapprochée par ses charactères d'une espèce vivante de la Mer Rouge, et d'une autre fossile du terrain nummulitique de l'Inde que M. d'Archiac a fait connaître sous le nom de *Vulsella lignium*."

I have made every effort to see the specimens here referred to, but without success. I am not aware that the genus has been found in the London basin, or anywhere but at Barton; and all the specimens that I have seen may, in my opinion, be referred to one species, but whether that be the true *deperdita* I cannot say.

PECTEN. *Pliny, Aldrovandus*, &c.

Ostrea (sp.).	*Linn.—P. opercularis*,	Sect. *a*.
Hinnites.	*Sow.* (not *Defr.*).—*P. pusio*,	,, *b*.
Janira.	*Schum.—P. maximus*,	,, *c*.
Neithea.	*Drouet.—P. quinquecostatus*,	,, *d*.
Pleuronectia.	*Swains.—P. pleuronectes*,	,, *e*.

Gen. Char. Shell lenticular or sub-orbicular, sometimes ovate, sub-equilateral, generally inequivalve; ornamented with radiating striæ or more or less elevated ribs: beaks approximate and acute, with a projecting and unequal auricle on each side of the umbo; pedal region slightly sinuated, right valve generally the more convex; connexus bipartite, the ligamental portion narrow on the straight hinge-margin, cartilage placed in a central pit,

elongately triangular; impression of the adductor somewhat obscure, excentric; double pedal impression visible in right valve, obsolete in the left; impression of the mantle not well defined.

Animal, with the edges of the mantle disconnected all round except at one part, which serves to separate the inhalent from the excurrent canal; margins double, each bearing a row of tentacular filaments, and at the base a row of black eyelets (*ocelli*); foot small, sub-cylindrical or digitiform, grooved, and byssiferous in the young state.

This constitutes a well-marked group, although the species present considerable diversity of character in their exterior ornaments. The valves are generally covered with radiating ribs or striæ, and in the very inequivalved species, of which *P. maximus* is the type, the rays are large and elevated, while at the other extremity, such as *P. pleuronectes*, the valves are nearly smooth, though still preserving the outward form and other characteristics of the genus.

The foot of the animal is very small and incapable of being extruded, and probably the only use it makes of this organ is to spin a byssus, which is employed principally in the young state; in some species, the animal when more advanced in age is capable of considerable locomotion.[1] In Chemnitz 'Conch. Cab.,' vol. vii, p. 261, vig. xi, there is a woodcut which represents the *imaginary* animal of *Pecten* (*opercularis?*) with two distinct and separated siphons, prettily ornamented with setæ or fibrillæ projecting beyond the margin of the shell, and a large geniculated foot is protruding to some distance in an opposite direction.

There is always more or less difference in the magnitude of the two valves in the shells of this genus, but it is in those species which lie habitually on one side that the great inequality is most distinct; the convex or tumid valve, being buried in the sand or mud, is usually colourless or fainter in ornament than the upper or flat valve, which is always exposed to the light.

The genus has a very extensive vertical range, the British species having been obtained alive by Mr. M'Andrew from the shore to the depth of 150 fathoms, though the most frequented habitats of two edible species, *maximus* and *opercularis*, are upon banks that do not extend beyond the range of thirty fathoms. Its geographical range is very extensive.

[1] The stationary habit of this genus is generally by means of a byssus; there is one species *P. pusio* of British authors, which fixes itself by the outside of the shell, like the oyster, but, unlike that genus, it employs the right valve, or that in which is left a sinus for the byssus; sometimes the whole of this large valve is soldered to the rock. In this it is connected with *Hinnites* (Defr.), which, however, is very different in all other respects. I have not seen a fossil *Pecten* possessing such a habit.

1. Pecten bellicostatus, *S. Wood.* Tab. VIII, fig. 11, *a, b.*

Spec. Char. Testâ crassâ, æquivalvi, orbiculari vel lenticulari, æquilaterali, costatâ; costis 20-24 *sub-rotundis, striatis et imbricatis; interstitiis lineatis et imbricatis; auriculis magnis, inæqualibus.*

Shell thick and strong, equivalved, orbicular or lenticular, equilateral, costated; ribs 20 to 24 somewhat rounded, striated, and strongly imbricated; interspaces also with imbricated rays: auricles large and unequal, one costated, the other striated.

Diameter, $1\frac{5}{8}$ths of an inch.

Locality.—Brockenhurst (*Edwards*).

Our shell is a handsome one and highly ornamented, and, judging from the number of specimens in Mr. Edwards' cabinet, it does not appear to have been scarce. In addition to the above formula, it may be further noticed, that the centre of the elevated rib is not only strongly and regularly imbricated, but the imbrices are long, overlapping, and slightly projecting; they are not reflexed, but lie over each other like ornamental tiling; there is a smaller ray on each side of the centre one, which is also imbricated, and the two lines or rays on the interspaces are likewise covered with small imbrications. The auricle on the pedal side of the right valve is a very large one, and ornamented with about half a dozen costæ, while the other is only striated with numerous rays; and the ears of the left valve are both striated; angle of divergence, 90°. The nearest approach to this species is *P. Thorenti*, D'Archiac, Tr. Geol. Soc. Fr., 2d sér., t. xi, pt. 1, p. 211, pl. 8, figs. 8, 8, *a, b*, which much resembles it in the ornament, but the auricle of that shell is so much smaller that I must presume the two to be different. The figure there taken was from a solitary specimen, and the auricle, if natural, does not appear to me to be perfect.

2. Pecten carinatus, *J. Sowerby.* Tab. IX, fig. 5, *a, b.*

Pecten carinatus.	*J. Sowerby.*	Min. Conch., t. 575, 1828.
—	—	*Prestwich.* Journ. Geol. Soc., 1847, p. 405.
—	—	*Morris.* Cat. Brit. Foss., p. 178, 1854.

Spec. Char. P. testâ orbiculari, lenticulari, æquivalvi, æquilaterali, costatâ; costis (circa 20) *subæqualibus, rotundatis, in medio carinatis; interstitiis lævibus; auriculis subæqualibus.*

Shell orbicular, lenticular, equivalved, equilateral, costated; ribs about 20, nearly equal, rounded, with a sharp keel along the centre of each; interspaces generally naked, or only marked with fine lines of growth; auricles nearly equal.

Diameter, 1 inch.

Locality.—Barton.

I have seen this from one locality only. The solitary line spoken of by Mr. Sowerby, in 'Min. Conch.,' as generally running down the centre of the interspaces, is a character not constant; in some it is not visible, while in others this space is occupied with several lines. The spaces between the ribs are not quite so wide as the ribs themselves, and these show fine curving and radiating striæ. The keel in some individuals is large and strong, giving an almost angular form to the rib; but in general this keel is merely a sharp line upon the otherwise rounded costæ, closely approaching *P. reconditus*. The auricle on the pedal side is slightly the larger of the two, and in the right valve this auricle is costated and sinuated beneath, with three or four denticulations upon the margin of the shell.

3. Pecten corneus, *J. Sowerby*. Tab. IX, fig. 7, *a—d*.

Pecten corneus.	*J. Sow.*	Min. Conch., t. 204, 1818.
—	—	*Id.* in Dixon's Geol. of Sussex, t. 4, fig. 6, 1850.
—	—	*Nyst.* Coq. Foss. Belg., p. 299, pl. 23, fig. 1 *a*, *b*, 1843.
—	—	*Morris.* Cat. Brit. Foss., p. 178, 1854.

Spec. Char. P. testâ tenuissimâ, orbiculato-depressâ vel plano-lenticulatâ, æquilaterali, lævigatâ, vel obsoletè striatâ; striis irregularibus; umbonibus acutis; auriculis subæqualibus, rectangulis, supernè prominentibus, tenuissimè striolatis.

Shell very thin, orbicular, depressed, or of a flattened lenticular form; smooth, or with fine, nearly obsolete striæ; beaks sharp; auricles nearly equal, rectangular; generally with fine radiating striæ.

Diameter, $2\frac{3}{4}$ inches.

Localities, Bracklesham, Bramshaw, Brook, Stubbington (*Edwards*), Cuffell (*Prestwich*); var. *corneolus*, Highgate (*Wetherell*).

Belg., Les sables de Lacken, Jette, Forêt, St. Gilles (*Nyst*).

This species is abundant at Bracklesham, but, on account of its extreme tenuity, is not very common in cabinets. Our shell, which is smooth to the naked eye, exhibits under a common hand-glass fine diverging striæ, most distinct near the margins of the shell, and in well-preserved specimens they are plainly visible all over; it is also rayed irregularly on the inside. The auricles are plain and smooth, except under a magnifier, when the same kind of fine radiating striæ may be seen as are upon the shell. There are at the base of the auricles, on the interior, two prominent diverging teeth, those in the right valve being higher and smaller than in the other, and the adductor muscle-mark is very conspicuous, generally of a darker colour; this is large and rounded, and in the right valve, which is the deeper or more convex one, it is higher in the shell or nearer to the hinge than in the left or flatter valve, where it is more in the centre, giving a more powerful action to that valve, and the mark of the mantle is visibly impressed upon the interior. The shell is nearly orbicular, but sometimes the diameter is greater longi-

tudinally, sometimes the reverse; the ears are slightly unequal, the pedal one being a trifle the larger. The shell diverges from the umbo at an angle of about 120°, and the divergence of the lines upon the fainter portion of the shell at about 80°.

The typical specimens of this species are from Selsey, Bracklesham, and Stubbington, where they attain to full proportions. There are also specimens found in the London clay at Hampstead, assigned to this species; these are seldom more than half the diameter of the Sussex shell, and may be considered as a variety, which I will call *corneolus*, Pl. IX, fig. 7, *d*. The difference in magnitude would not of itself be sufficient to entitle these shells to the position of a variety;[1] but there is a slight variation in the right auricle, which is rather more rounded, and in some of the specimens the proportions are different, giving them a more ovate form.[2]

4. Pecten contubernalis, *S. Wood*. Tab. IX, fig. 8.

Spec. Char. P. testâ tenui, subcorneâ, orbiculato-depressâ, æquilaterali, tenuissimè striatâ, striis radiatis argutis; umbonibus acutis; auriculis subæqualibus, supernè rectangulis, costellatis.

Shell thin, subcorneous, orbicularly depressed, equilateral, and very finely striated, striæ thin and radiating, beaks acute; auricles nearly equal, and prominently radiated or costated.

Diameter, $1\frac{1}{8}$th inch.

Locality. Herne Bay (*Edwards*).

This shell appears to present differences sufficient to entitle it to an isolated position: the elevated radiations or costæ upon the auricles will distinguish it; and the whole surface is more strongly marked by the fine, divaricating, and curving striæ with which it is covered, and these extend over the auricles. I have seen but one specimen, which is in Mr. Edwards' cabinet, but this differs so materially that I think it cannot belong to the preceding species. The auricles are comparatively much larger than those of *corneus*: in that shell their length does not exceed $\frac{1}{10}$ths of the diameter of the valves, while in this species they are $\frac{2}{10}$ths; and although the young shells of Pecten have generally larger ears, comparatively, than when full grown, a great difference may be seen in specimens of the two species of corresponding size.

[1] Since writing the above, I have seen a specimen of this variety in Mr. Wetherell's cabinet, which measures $1\frac{3}{4}$ inch in diameter.

[2] At p. 72, t. 11, 'Anim. s. Vert. du Bassin de Par.,' M. Deshayes has pointed out the confusion that exists among species with the above name, and enumerates not less than seven, but which he considers to be quite distinct. One of these seven (*P. corneus*, Melville, pl. 111, figs. 11, 12,) very strongly resembles the young state of our shell, corresponding with the Highgate variety (*corneolus*).

5. Pecten duplicatus, *J. Sowerby*. Tab. VIII, fig. 10, *a—c*; and Tab. X, fig. 3.

Pecten duplicatus. *J. Sow.* Min. Conch., t. 575, 1828.
— — *Morris.* Cat. Brit. Foss., p. 174, 1854.

Spec. Char. P. testâ orbiculari, depressâ, radiatâ; valvâ dextrâ sublævigatâ; alterâ costellatâ; costellis numerosis, imbricatis; auriculis subæqualibus.

Shell orbicular, depressed, radiated; one valve nearly smooth or with obsolete costæ, the other with thin rounded ribs, 14 to 16, imbricated, increasing with age by the interposition of an additional rib; auricles nearly equal.

Diameter, $1\frac{1}{2}$ inch.

Localities. Highgate, Primrose Hill (*Wetherell*), *a*, *b*, *f*, Haverstock Hill, *c*, Muswell Hill (*Edwards*).

A strongly marked and ornamental species, and in the living condition probably a handsome shell. The specimens in cabinets are by no means abundant, and rarely in good condition. Mr. Sowerby, in 'Min. Conch.,' represents one of his valves as quite smooth. In all Mr. Edwards's specimens, the right valve has more or less depressed or obsolete costæ, and as many as thirty of these faint rays may be counted, and these are distinctly visible in the interior. The left valve is ornamented with about sixteen thin, rounded, and imbricated rays on the younger shell; these are doubled, and again doubled, as the shell increases in size, by the interposition of a rib; they are all closely and regularly imbricated, but not the interspaces.

6. Pecten idoneus, *S. Wood.* Tab. VIII, fig. 9, *a*, *b*.

Spec. Char. P. testâ inæquivalvi? suborbiculari, subdepressâ, æquilaterali, costatâ, et concentricè squamulatâ; costis 13-15 *elevatis, magnis, subquadripartitis; auriculis, æqualibus radiantibus.*

Shell inequivalve? suborbicular, somewhat depressed, equilateral, costated, and concentrically striated; ribs 13-15, elevated, large, and ridged; auricles equal and radiated.

Diameter, $1\frac{1}{4}$ inch.

Localities. Hill Head, Stubbington (*Fisher*), Brook near Lyndhurst (*Edwards*).

This is an ornamental shell, and appears quite distinct. It was first discovered by the Rev. Osmond Fisher, who has obtained about a dozen specimens from the first locality, and Mr. Edwards has very recently added three to his cabinet from the latter.

In well-preserved specimens, the ribs are ornamented with one elevated and two lateral ridges, dividing the surface of the rib into four portions; the interspaces are about as broad as the ribs themselves, in which a ray or two may occasionally be seen on the outer or older portion of the shell; the surface, when perfect, is ornamented with regularly concen-

tric striæ or small imbrications. The auricles are nearly equal, and they are ornamented with eight or ten moderately sized rays.

7. Pecten Prestwichii, *Morris*. Tab. VIII, fig. 7, *a*, *b*.

Pecten Prestwichii.	*Morris*. Geol. Journ., vol. viii, p. 266, t. 16, fig. 8 *a*, *b*, 1852.		
—	—	*Id.* Cat. Brit. Foss., p. 178, 1854.	
—	—	*Desh.* An. sans Vert. du Bas. de Par., p. 75, pl. 79, figs. 4—6.	
—	breviauritus?	*Id.* - - - - p. 74, -	1—3.

Spec. Char. "*P. testâ tenui, compressâ, radiatim obsoletè costatâ, costis subsquamosis, interstitiis obliquè irregulariter striatis; auriculis inæqualibus, radiatis.*"

"Shell thin, compressed; margin orbicular, with a rectangular beak; radiated with very slightly raised ribs, distinctly imbricated, the intervening furrows twice as large as the ribs; irregularly and obliquely striated; ears unequal, with three or four radiated costæ."

Diameter, 1 inch.

Localities. Richborough Castle (*Prestwich*), Herne Bay (*Bowerbank*).

This species possesses about sixty small ribs or rays, very slightly elevated, and the surface is covered with diverging or divaricating and curved striæ; these are most conspicuous as they approach the pedi- and siphoni-lateral margins; the auricles are comparatively large, unequal in size, with a small sinus at the base of the right one; these auricles are covered with about five or six rays. The diverging striæ appear to cover our shell, passing over the riblets, as well as between them; and there appears to be a large muscle-mark under the pedal auricle. I have seen only two specimens.

The British fossil corresponds so closely with the older species, *P. breviauritus*, that, judging alone from figure and description, I am unable to detect any difference which can fairly be called specific; and unless there be greater distinction shown between specimens when compared, the name of our species will have to be changed. In the figure given in the 'Geol. Journ.,' above referred to, the artist has reversed the auricles.

8. Pecten reconditus, *Solander*. Tab. IX, fig. 3, *a*—*d*.

Ostrea recondita.	*Solander*. Brand. Foss. Hant., p. 42, pl. 8, fig. 107, 1766.	
Pecten reconditus.	*Nyst*. Coq. Foss. Belg., p. 302, pl. 25, fig. 2 *a*, *b*, 1843.	
—	—	*J. Sow.* in Dixon's Geol. of Suss., t. 3, fig. 27, 1850. *non.* Sow. Min. Conch., t. 575, figs. 5, 6.
—	—	*Lyell*. Belg. Tert., loc. cit. ant. p. 353, 1852.
—	—	*Morris*. Cat. Brit. Foss., p. 179, 1854.
—	plebeius.	*Tennant*. Strat. List. Brit. Foss., p. 31, 1847.

Spec. Char. P. testâ æquivalvi, orbiculari vel subovatâ, costatâ, costis 18-24 *convexis, lævigatis; sulcis æqualibus, aliquando squamulosis; auriculis inæqualibus.*

Shell equivalve, orbicular, sometimes sub-ovate costated; ribs 18-24, convex and smooth; interspaces about equal in breadth to the ribs, and occasionally sub-squamulose or imbricated; auricles unequal.

Diameter, $1\frac{1}{4}$ inch.

Localities. Barton.

Belgium (*Nyst*).

The prevailing Pecten at Barton possesses the above characters, and it may be considered the representative of the genus in that deposit, as the 30-*radiatus* is at Bracklesham; and although perhaps this is not quite so variable as the Bracklesham shell, I have found it exceedingly difficult to fix the species.

The generality of our specimens are nearly circular; sometimes the diameter from the umbo to the ventral margin is greater than in the opposite direction, but not often so. Brander's figure is a deviation in excess. I have been unable to find the type specimen from which his figure was taken, but, from the general accuracy of his other species, it was most probably a faithful representation, and in my own cabinet is a specimen somewhat approaching that form; so that the above name is considered to be applicable to this common Barton shell.

Specimens have in general from 18 to 24 ribs, and the spaces between them equally divide the surface of the shell; the ribs are generally smooth, and so are sometimes the interspaces, but they occasionally show numerous and close imbrications, and the surface is covered with fine curved and diverging striæ, most conspicuous between the ribs.

The auricles are unequal in size; the one on the pedal side of the right valve is large, and has six or seven scaly rays, the upper, as usual, larger and more distant, and at the base of this is a considerable sinus for the byssus, with ridges or denticles on the body of the shell, varying from four to ten; the other auricle is also rayed. The muscle-marks are not immediately or strictly in opposition; they are situated higher up or nearer the hinge in the right valve, and lower down or more in the centre in the left, but it is so with several species in this genus.[1]

[1] Some species exhibit more than ordinary variation in individuals, diverging in form far beyond what is shown in any proximate species; others, living under the same (apparently) adverse circumstances, are not affected in a similar manner, but preserve a uniformity of character without any deviation, showing an inaptitude to change under similar conditions. Where bivalve shells have displayed the greatest aberration from what is presumed to be the normal form or typical outline, the change seems to me rather to have been more towards a concentration, as it were, so that a variety of a bivalve, whose typical form would have proportions of length greater than height, would be most shown in a deviation from that type, by a reduction of length with a tendency to the orbicular. An orbicular shell in its deviations would, on the contrary, be rather in the direction of an enlargement or extension in its height. I might mention two or three Crag forms that strongly exhibit this tendency, viz., *Venus casina*, *Cardita senilis*, and *Mya truncata*; but this variation seems to be from a failure of vigour, as the abnormal form is generally rare.

M. Deshayes, in speaking of the Paris Basin shell, *P. plebeius*, says it is variable, with 20 to 28 ribs, and he makes two varieties.[1] M. Nyst says of *P. reconditus*, from Belgium, that he has seen but one valve, and this, judging from his figure, does not differ from our shell. The specimens from Bracklesham, (as I have elsewhere said), figured by Mr. Sowerby, and assigned with doubt to *plebeius*, most probably belong to 30-*radiatus*.

There appears to be less variation of form in those bivalve shells whose outline is circular or lenticular than there is in those whose normal condition is more elongated. Pectens are, in general, I think, uniform in outline; and when a specimen like the one figured by Brander presents so great a difference, there is more reason to consider it as belonging to a distinct species, than as a variety of one that is orbicular; and it was only after long and careful examination that I could, on that supposition, bring myself to believe it to be only a variety. Brander's figure may, however, be the representation of a distinct species; if so, I have not seen it.

9. Pecten squamula, *Lamarck*. Tab. IX, fig. 6.

Pecten	squamula.	*Lam.* Ann. du Mus., t. viii, p. 354, No. 3, 1806.
—	—	*Id.* Hist. des An. s. Vert., t. vi, p. 183, No. 27.
—	—	*Desh.* Coq. Foss. des Env. de Par., t. i, p. 304, pl. 45, figs. 16—18.
—	—	*Id.* An. sans Vert. du Bassin de Par., t. ii, p. 74, 1860.
—	—	*Id.*, 2d edit. Lamk., t. vii, p. 164, No. 34, 1836.
—	—	*D'Orbigny.* Prod. de Palæont., t. ii, p. 326, No. 528, 1850.
—	—	*J. Sow.* in Dixon's Geol. of Sussex, pp. 94, 172, pl. 3, fig. 29, 1850.
—	—	*Morris.* Cat. Brit. Foss., p. 179, 1854.
—	squamulosus.	*Desh.* Ency. Meth. Vers., t. iii, p. 717, No. 7, 1832.

Spec. Char. P. testâ minimâ, rotundatâ, depressâ, æquilaterali, æquivalvi; extùs lævissimâ, intùs octo ad decem costatâ; auriculis magnis, subæqualibus.

Shell minute, rounded, depressed, equilateral, equivalve; very smooth externally, inside with eight to ten costæ; ears large, slightly unequal.

Diameter, $\frac{1}{8}$th of an inch.

Localities.—Bracklesham, Bramshaw (*Edwards*).

France, Chaumont et Laon (*Desh.*)

This is exceedingly rare; I have seen it only in Mr. Edwards's cabinet. It is a miniature representation of *P. pleuronectes*, and, like that species, is externally smooth, and

[1] The shell from the Paris Basin appears to differ from our species. In some specimens of *plebeius*, in Mr. Edwards's cabinet, sent to him by M. Deshayes, the rays are smooth at the top, rounded and imbricated at the sides, and I cannot see the fine curving and diverging striæ between the ribs which are so distinct in *P. reconditus*.

has its rays or costæ upon the inner surface: the exterior seems to have been glossy, and the left valve was probably ornamented with colour in zigzag, somewhat like *P. similis*; the shell is extremely thin, and the internal costæ can be distinctly seen on the outside. The auricles are large, as is usually the case in minute species of this genus, and the one on the pedal side is the larger of the two; this in the right valve is rounded at the angles, and ornamented with about half a dozen elevated and imbricated rays, and sinuated near its junction with the shell. In the left valve, the auricle on the pedal side is also larger, but it is neither rounded at its upper angles, nor sinuated beneath. It is most probably identical with the Paris Basin shell, and is not very distantly related to another small fossil species, *P. squama*, Sow. (*P. pygmæus*, Münst.), but this is said to be furnished with as many as twenty rays on the inside of the valves. The figure with this name in 'Goldf. Pet. Germ.,' pl. 99, fig. 6 *a*, *b*, appears a larger shell; but it has the same number of internal ribs, and corresponds in other respects. Nilsson, 'Petrificana Suecana,' p. 24, t. ix, fig. 18 A B, describes a species, *P. inversus*, which is intermediate in size between *squamula*, Goldf., and *pygmæus*, Münst.

Pecten squamula (Geinitz 'Charak. der Schicht und Petr. des Säch. Böhm Kreid,' p. 83, taf. xxi, fig. 8) is altogether a different species.

10. Pecten 30-radiatus, *J. Sowerby*. Tab. IX, fig. 4, *a*—*h*, and Tab. VIII, fig. 8.

Pecten	30-radiatus.	*J. Sow.*	in Dixon's Geol. of Suss.,	p. 172, t. 3, figs. 30, 31,	1850.
—	40-radiatus.	*Id.*	- - -	p. 173, fig. 33.	
—	plebeius.	*Id.*	- - -	p. 172, figs. 28, 32.	
—	multistriatus?	*Morris.*	Cat. Brit. Foss.,	p. 178,	1854.

Spec. Char. P. testâ variabilis, æquivalvi, orbiculari, radiatim costatâ, costis numerosis, rotundis vel angulato-sulcatis; interstitiis interdum squamulis, minimis, asperatis; quandoque radiatis; auriculis inæqualibus.

Shell variable, equivalve, orbicular, with numerous ribs, rounded or subangulated; interspaces sometimes with small, rough scales or lines of growth, sometimes with an intermediate ray; auricles unequal.

Diameter, $1\frac{5}{8}$ths inch.

Localities. Bracklesham, Bramshaw (*Edwards*).

The deposit at Bracklesham Bay has yielded an abundance of specimens belonging to the genus Pecten, and these present an unusual amount of variation, rendering a specific determination a task of extreme difficulty. Mr. Edwards had previously examined his specimens; the accompanying notes were in his cabinet, and I have his permission to transcribe them:

"(*a*) Costæ 24, 25, round, finely imbricated with intermediate costellæ, imbrications continued over the interstices. Interstices deep; shell sub-orbicular.

(*b*) Costæ 24—28, round, imbricated; imbrications more distant than in *a*; interstices shallow; costellæ occasional; shell tranversely sub-orbicular.

(*c*) Costæ 18—32, round, finely imbricated; costellæ occasional; shell nearly orbicular.

(*d*) Costæ acute.

(*e*) Multistriatus?

(*f*) Tripartitus?

(*g*) Transversely sub-orbicular, costæ 30, coarsely imbricated.

(*h*) Costæ round, smooth." (*Edwards.*)

My own observations pretty nearly coincide with the above, and my formula will stand thus:

a. Ribs 25—32, rounded and smooth, without an intermediate ray. The smoothness may possibly be from attrition or decortication.

b. Ribs 24—32, rounded and imbricated, without intermediate ray.

c. „ 25—28 „ „ with „ „

d. „ 24—28 tripartite, imbricated all over, without intermediate ray.

e. „ 24—28 „ „ with „ „

f. „ 26—28 acute, subcarinate, and slightly imbricate, without intermediate ray.

Although we have both attempted the above divisions, I fear the lines of separation will be anything but distinct between these variations.

One perfect specimen, with the two valves united, shows the ribs quite smooth and rounded; another, equally perfect, has the younger portion of the shell with smooth ribs, while the outer and older portion is strongly imbricated both over the ribs and between them; and on another specimen the younger portion is imbricated, and the older portion smooth, uniting thus in one individual the characters of what are called varieties. Where the intermediate ray is developed, it is generally most prominent at the margins. I believe the figures of Mr. Sowerby, above referred to, are representations only of varieties of this variable species. The 40-*radiatus* I imagine to be one of the lesser number of ribs, with the intermediate ray elevated into a primary one. The diameter of the shell is *generally* a trifle in excess, measuring from the pedilateral to the siphonilateral margin; but in some specimens the proportions are decidedly reversed. The auricles are rather large and

unequal, and are ornamented with about half a dozen (5-7) primary rays, generally imbricated; the two upper often coalesce, particularly in the right valve, beneath which there is a deep sinus.

P. opercularis is mentioned in Mr. Prestwich's list of species, in his paper on the London clay (p. 405, Geol. Journ.), as from Bracklesham. This may perhaps have been a dead specimen of the recent shell, or perhaps a specimen from the newer Tertiaries of that locality; or it may have been a variety of 30-*radiatus*. I have seen nothing from the older Tertiaries that can be united with the recent species, *opercularis*.

Pecten subreconditus, D'Orb. (Prod. Pal., 1850, p. 393, No. 1106), is, I think, not an Eocene shell. He refers to 'Sow. Min. Conch.,' pl. 575, figs. 5, 6, which are representations of a Crag specimen of *opercularis*. *P. subreconditus*, Pictet (pl. 83, fig. 10), who refers to D'Orbigny, is probably the same.

LIMA, *Bruguière*, 1792.

Generic Character. Shell ovate, equivalve, generally inequilateral; the pedal region oblique and gaping. Sometimes the shell is straight and equilateral; exterior occasionally smooth, more often radiately ribbed or striated, rough or squamous. Hinge area triangular, extended into auricles; connexus bipartite, with central pit; adductor impression large, lateral, and double; two small pedal scars.

Animal has the mantle margins disunited, and fringed with a double row of tentacular filaments, the inner one long and pendulous; ocelli inconspicuous; foot small, finger-like, furnished with a byssal groove.

Several divisions have been made of the shells that will come into the above formula.

Limea has been proposed for those species which have a row of teeth or crenulations upon the hinge margin, and *Limatula* for those which are equilateral and closed.

In general, the oblique species (*Lima* proper) have one side straight, and the other rounded, with one opening; but this is by no means constant, as there is often a large gape on both sides. The shell of *Limatula* has sometimes a row of crenulations, while the same form of shell is known to be without them. *Limea*[1] has teeth on each side of the cartilage-pit upon the hinge-margin; these are sometimes in a rectangular position, at others they are placed obliquely to the hinge-line, and these are generally upon shells that are equilateral or nearly so, but they are not confined to that form of shell; and in the oblique species there

[1] Goldfuss has figured two species of Secondary fossils, one from the Lias, *L. acuticosta*, pl. 107, fig. 8, with large dentations.

is often a large distinct tooth in one valve, that interlocks into a depression in the other. M. Loven, in speaking of the animal of *Limea Sarsii*, says that the margin of the mantle is destitute of those tentacular filaments which form so rich an ornament to the animal of *Lima hians*.

In the fossil genus *Plagiostoma*, there is a large gape on the rounded or siphonal region; but this distinction is by no means a generic one, as the same character may be seen in shells of the living species of *Lima* proper.

Some of the animals of this genus spin a byssus, and are said to be fixed; but others are able to swim with considerable vigour, like the *Pectens*, by opening and rapidly closing or flapping their valves. The animal of *Lima hians* is a most beautiful object, sometimes of a deep crimson colour, with an orange-coloured mantle; and it makes an artificial burrow with fragments of coral, shells, and sand. The recent shell of this genus is always white, and, according to Dr. Carpenter, its outer layer consists of coarsely plicated, membranous lamellæ; the inner is perforated by minute tubuli, forming a complete network.

This is wholly a marine genus, and the species are found in various parts of the world, from Norway to India, Australia, and the West Indies, and they present no special indication of climate. Mr. McAndrew obtained the largest living species, measuring $5\frac{1}{2}$ inches in height and $4\frac{1}{4}$ long (*excavata*, Chemn.), on the coast of Finmark, and the European species possess a vertical range from 1 to 150 fathoms. A Permian fossil strongly resembles this genus, and it has continued through all the Secondary periods in large numbers; the Tertiaries are somewhat scantily supplied.

1. Lima compta, *S. Wood*. Tab. XI, fig. 5.

Spec. Char. L. testâ tenui obovatâ, valdè obliquâ, subdepressâ, inæquilaterali; striatâ vel costulatâ, striis vel costulis numerosis, angustis, regularibus, acutis, scabris; auriculis magnis æqualibus; cardine angusto, recto, simplici; umbonibus acutis, subpromenentibus.

Shell thin, obovate, very oblique, somewhat depressed, inequilateral, striated or costulated, striæ or riblets numerous, narrow, sharp, regular, and rough; auricles large and equal; hinge-line straight, with pointed and rather prominent beaks.

Longest diameter, $\frac{3}{4}$ of an inch.

Locality. Barton (*Edwards*).

One specimen is all that I have seen, and this is not quite perfect; but it differs from any species I am acquainted with, as indicated by the lines of growth. I believe it to be distinct. The entire surface of this shell is covered with radiating striæ, and these are numerous and regular. It somewhat resembles *L. tenuis*, Desh. (An. sans Vert. du Bassin de Par., t. ii, p. 67, pl. lxxviii, figs. 20—22); but it is more oblique than that figure, having the umbo incurved, and not so prominent; there is also, seemingly, a deeper sinuation under the auricle in the siphonilateral margin, and the rays upon our shell are more numerous and less regular.

2. Lima expansa, *J. Sowerby*. Tab. XI, fig. 6.

Lima expansa. *J. Sow.* in Dixon's Geol. of Sussex, pp. 94, 172, t. 3, fig. 34, 1850.
— — *Morris.* Cat. Brit. Fossils, p. 172, 1854.

Spec. Char. L. testâ parvâ, obliquè orbiculari, subtransversâ, tenui, fragili, subæquilaterali, depressiusculâ; extùs striis radiantibus ornatis, interstitiis punctatis; cardine brevi, auriculis minimis, subæqualibus.

Shell small, obliquely orbicular, slightly transverse, thin, fragile, and subequilateral; externally ornamented with about 40 rays, interstices punctated; hinge short, with small, nearly equal auricles.

Diameter, $\frac{1}{4}$ of an inch.

Locality. Bracklesham (*Edwards*).

"Much more orbicular than any other *Lima* I know, but much too oblique for a *Pecten*. It is extremely rare. Mr. Edwards has one nearly perfect valve, and Mr. Dixon a fragment." (*Sowerby.*)

This small shell somewhat resembles in outline *L. dilatata*, Desh. Coq. foss. de Par., p. 298, pl. xliii, figs. 15—17. Our shell has about 40—42 rays, which are broad and flat, the interspaces narrow, and prettily ornamented with transverse projecting ridges, between which are rounded and deep punctations. The hinge-area in Mr. Edwards' specimen is broken and not very distinct; it was probably small, with small auricles.

3. Lima soror, *S. Wood.* Tab. XI, fig. 7, *a*, *b*.

Lima obliqua. *Morris.* Catal. Brit. Foss., p. 172, 1854.

Spec. Char. L. testâ ovato-elongatâ, obliquâ, inæquilaterali, tenui, striatâ, pedi-regione lævigatâ; striis angulatis, irregularibus; umbonibus parvis, acutis; auriculis minimis, brevibus, æqualibus.

Shell ovately elongate, oblique, inequilateral, thin, striated, with small angular and irregular ribs or riblets; beaks small and pointed, auricles short and equal.

Longest diameter, $\frac{7}{8}$ths of an inch.

Locality. Highcliff, Barton (*Edwards*).

There are two specimens of this species in Mr. Edwards' cabinet, and they are in a sufficiently perfect condition to show a considerable, and what I presume is a specific, difference from *L. obliqua* of Deshayes, if I may judge from figures and descriptions of that shell.

In the 2d ed. of Lamarck, tom. viii, p. 120, the author says, "toute sa surface est couverte de striæ longitudinales."

In the present species, the pedal region, from the margin to the elevated ridge or most tumid portion of the shell, is quite free from striæ of any kind; and on the centre the striæ are small, close, and numerous, becoming larger and wider as they diverge from the middle towards both regions; the hinge-line is short, and there is a small gape or sinuation in the siphonilateral margin immediately under the auricle; the umbo is small, sharp pointed, but not very prominent, unlike that represented in the French shell, which has also apparently a greater height. With these differences, I have ventured to propose for the English fossil a new name.

SPONDYLUS. *Linn.*, 1767.

Spondylus. *Rondelet*, 1555. *List.*, 1686.
Spondylites (sp.). *Aldrov.*, 1648.
Argus et Argoderma (sp.). *Poli*, 1795.
Plagiostoma (sp.). *Lamk.*, 1819.
Dianchora. *J. Sowerby*, 1814.
Podopsis. *Lamk.*, 1819.
Pachytos. *Defrance*, 1825.
Pachyta. *Menke*, 1830, fide *Herrm.*
Pachytus. *Agass.*, 1847.

Generic Character. Shell irregular, generally thick and strong, and attached by the right valve; ribbed or costated radiately; more or less spiny or foliaceous; eared; umbones often remote; lower or attached valve with a triangular hinge-area; connexus bipartite, cartilageous portion between two curved interlocking teeth in each valve; impression by the adductor double.

Animal with the edges of the mantle disconnected as in *Pecten*, and furnished with two rows of tentacular filaments; foot small, cylindrical, truncated.

The species of this genus in the recent state are about thirty, and these are distributed over the globe, but mostly in tropical or subtropical regions; many of these are beautifully coloured, and highly ornamented with spines or broad foliaceous projections; these appendages are sometimes long and pointed, while at others they are merely rudimentary spines. These shells are known by the name of spiny oysters, but they are wholly distinct from the genus *Ostrea*, and approach nearer to *Pecten*, which they resemble in some characters. The hinge-area is furnished with prominent denticles, two in each valve; those in the lower are small, and situated close to the cartilage; the two teeth of the upper valve are more remote, and lock into depressions outside the smaller teeth of the lower valve. The connexus is more or less internal, opening the shell by

expansion; but in many it is bipartite, extending outwardly in a furrow, like the oyster; a small ligament sometimes occupies the hinge-margin, and this margin is occasionally rugose or faintly denticulated. The lower valve is generally the most spiny, and in the recent state is nearly colourless; this is the right valve, and the one by which it is most frequently attached. Many fossil species are known, commencing low in the Secondary series. The structure of the shell in some of the species has long been noticed as being composed of two different layers (and in the recent shells of two different colours), the inner being very distinct from the outer, and very destructible.

This genus in the fossil state is supposed to indicate, for the formation in which it is found, somewhat of a tropical character; it may be so as a general rule, but three species are found at the present day, in the Mediterranean, in association with northern forms. It is purely a marine genus, and the living species are generally found in deep water.

SPONDYLUS RARISPINA, *Deshayes*. Tab. VIII, fig. 1, *a*, *b*.

SPONDYLUS RARISPINA.	*Desh.*	Coq. Foss. des Env. de Par., p. 321, pl. 46, figs. 6—10.
—	—	*Id.* An. sans Vert. du Bassin. de Par., t. ii, p. 90, 1860.
—	—	*Nyst.* Coq. Foss. Belg., p. 308, pl. 25, fig. 4 *b*, 1843.
—	—	*D'Orbigny.* Prod. de Paléont., t. ii, p. 393, No. 1116, 1850.
—	—	*Morris.* Cat. Brit. Foss., p. 182, 1851.
—	—	*Pratt.* Proc. Geol. Soc., vol. iv, p. 158, 1843.
—	—	*D'Archiac.* Tr. Geol. Soc. Fr., 2d ser., t. iii, pt. ii, p. 437, 1850.
—	—	*J. Sow.* in Dixon's Geol. of Suss., p. 173, 1850.
—	—	*Bellardi.* Mém. de la Soc. Géol. de Fr., 2d ser., t. iii, p. 260, 1852.
—	—	*Id.* Catal. ragionato dei foss. Numm. d'Egitto, p. 26, No. 66, 1854.

Spec. Char. Sp. testâ ovato-rotundatâ, obliquâ, brevi-auritâ; sulcis vel costis radiantibus, numerosis; majoribus spinis, raris, echinatis, alteris subæqualibus muticis.

Shell roundly ovate, oblique, with small auricles, covered with numerous radiating striæ or riblets, the larger having distant spines or imbrications.

Longest diameter, $1\frac{1}{2}$ inch.

Localities. Bracklesham (*Edwards* and *Dixon*).
Belgium, les sables d'Uccle, de St. Gilles, et de Dieghem (*Nyst*).
France, à Chaumont (*Deshayes*), Biaritz (*D'Arch.*), Nizza (*Bellardi*).

I have seen only two specimens of this species, and those are both of the left or free valve. Both these specimens are alike oblique in form; the larger rays are sparingly covered with small spines or imbrications, and between these are three, sometimes two, intermediate rays, which are generally smooth. This valve is much depressed; the right or adherent one was probably tumid. The hinge is strong, and in this valve there are

deep and large depressions for the reception of the teeth of the opposite one. Auricles small. The muscle-mark is large, rounded, and eccentric. This species strongly resembles *Sp. Cisalpinus*, Brongniart, and may probably (as suggested by M. Deshayes) be only a strongly marked variety of that shell.

AVICULA. *Klein*, 1753.

Gen. Char. Shell inequivalve, inequilateral, obliquely oval; left valve the larger or more tumid, right valve with a byssal sinus; cartilage-pit oblique; hinge sometimes edentulous, at others with one or two small cardinal teeth, and an elongated lateral one; hinge-line rectilinear, with the extremity generally prolonged; muscular impressions large, subcentral; pedal scar high in the umbonal region; impression of the mantle entire; connexus ligamentous.

Animal obliquely triangular; the edges of the mantle disunited, except at one point where the juncture separates the incoming from the outgoing canals; margins fringed, and furnished with a pendant curtain; foot small, subcylindrical, or digitiform, grooved; byssus sometimes solid, with an expanded termination.

There is much difficulty in assigning a proper limit to this genus, which has so many near relations. Conchologists are greatly at variance as to what should be included within its generic boundaries. The hammer oyster (*Malleus*), a recent shell, with an extension of the hinge-margin on each side of the umbo, has been considered as not entitled to generic distinction; the young shell being extended only on one side, and it is then very like a true *Avicula*. There are also some fossils of the older rocks which bear a very strong resemblance; these have been elevated into genera, under the names of *Pterinea*, *Pteronites*, *Pteroperna*, *Ambonychia*, &c., each presenting some small distinctive character. The claim of *Meleagrina* to isolation appears to rest upon a less extended hinge-margin, than that which, in the type of this genus (*Mytilus hirundo*), gives such a winged-like form to that shell; this appendage is exceedingly variable in different species, and indeed is of different lengths in the individuals of the same species, the young differing from the parent shell; while also among the full-grown specimens, this character is by no means permanent in the same species. The form of the shell, divested of its extended hinge-line, bears a strong resemblance to that of *Mytilus*.

The connexus in this genus is in general simple, and spread over a large external area.

Twelve or thirteen species have been described from the French Eocene deposits, and a few from the more recent formations.

The only species of this genus now found on our own coasts and in the Mediterranean ranges, in the latter sea, according to Mr. M'Andrew, from eight to thirty-five fathoms.

1. Avicula arcuata, *J. Sowerby*. Tab. XI, fig. 3.

Avicula arcuata. *J. Sowerby*. Geol. Trans., 2d ser., vol. v, t. 8, fig. 15, 1834.
— — *Morris*. Cat. Brit. Foss., p. 163, 1854.

Spec. Char. Av. testâ elongatâ, obliquâ, arcuatâ, compressâ, lævigatâ, tenui; valdè inæquilaterali.

Shell elongate, oblique, and curved, compressed, smooth, thin; very inequilateral.

Longest diameter, $\frac{5}{8}$ths of an inch.

Locality. Hampstead (*Wetherell*).

All that I have seen is the unique specimen in Mr. Wetherell's cabinet. It appears to be distinguished by its curved form. *A. microptera*, Desh. (p. 290, pl. 43, figs. 18—20), resembles it in some characters, but is not so much curved.

2. Avicula media, *J. Sowerby*. Tab. XI, fig. 1, *a—d*.

Avicula media. *J. Sow.* Min. Conch., t. 2.
— — *Prestwich*. Geol. Journ., 1847, p. 401.
— — *Morris*. Cat. Brit. Foss., p. 163, 1854.
— — *Wetherell*. Phil. Mag., p. 464, 1836.
— — *D'Orb*. Prod. de Paléont., t. ii, p. 391, 1850.

Spec. Char. Av. testâ inæquivalvi, ovato-trigonâ, valdè obliquâ, lævigatâ, fragili; valvâ sinistrâ convexâ, tumidâ; valvâ dextrâ depressiore; umbonibus prominentibus, remotis; areâ cardinali magno.

Shell inequivalve, ovately trigonal, very oblique, smooth, and fragile, nacreous; left valve convex and tumid; right valve more depressed; umbo prominent, with a large and broad cardinal area.

Diameter, length 2 inches, height $1\frac{1}{2}$ inch.

Localities. *a*, *b*, *d*, Brockenhurst. *c*, Barton, Bracklesham, Hampstead (*Edwards*). Highgate, Chalk Farm, Potter's Bar (*Wetherell*). Sheppey, Basingstoke, Newnham (*Prestwich*).

This is by no means rare, and the specimens present a large amount of variation. In some individuals, the length of the hinge-line extends so far as to be perpendicular to the basal margin on the siphonal side, while in others this sub-auricle, if it may be so called, is considerably shorter. The Barton specimens are generally the more oblique, though not always so; the specimen figured from Brockenhurst is somewhat quadrate, and corresponds in that character with the specimens figured in 'Min. Conch.,' from Highgate. It is seldom that the outer surface is preserved, but in one specimen

from Barton, in which it is so, the right or flatter valve exhibits faint radiations; in one specimen of Mr. Edwards, (fig. 1, *c*,) of the left valve, these radiations are not visible, although the outer layer is well preserved and perfect, showing irregular and lamellated and somewhat undulating lines of growth.

3. Avicula papyracea, *J. Sowerby*. Tab. XI, fig. 2, *a*—*c*.

Avicula papyracea. *J. Sow.* Geol. Tr., 2d ser., vol. v, pl. 8, fig. 16, 1834.
— — *Morris.* Cat. Brit. Foss., p. 164, 1854.

Spec. Char. Av. testâ tenuissimâ, papyraceâ, obliquâ suborbiculari, compressâ, concentricè costulatâ aut undulatâ; auriculis minimis, inæqualibus.

Shell very thin, papyraceous, obliquely orbicular; much compressed; concentrically ridged or waved; ears small, unequal.

Longest diameter, 1½ inch.

Localities. b, Hampstead, Sheppy, Primrose Hill (*Wetherell*). *f. a.* Haverstock Hill (*Edwards*).

"An extremely thin, pearly shell, sometimes assembled in considerable masses." (*Sowerby.*) Although specimens are by no means rare, the shell is always compressed and distorted; indeed, all I have seen are literally flat. In outward form it is unlike the generality of shells of this genus, in having the hinge-line but little developed; it resembles a *Posidonia* in that character. A specimen in the Museum of the Geological Society, apparently belonging to this species, is marked Southend (*Warburton*).

PINNA. *Linnæus*, 1767.

Generic Character. Shell equivalve, cuneiform, or wedge-shaped; umbones at the pedal extremity, siphonal region truncated and gaping; connexus ligamentous, linear; hinge edentulous; adductor muscle-mark subcentral, large, ill defined.

Animal the shape of the shell; the margins of the mantle with a double fringe, and disunited except at the dorsal edge; foot elongated, grooved, spins a large, powerful, and silky byssus; attached by triple muscles to the centre of each valve.

This is a marine genus. The species range from low-water mark to sixty fathoms, and the animals live generally buried in the sand or mud, with the pointed end of their valves inserted; they are gregarious, large numbers congregating in one spot.

The composition of the shell in this genus appears to be different from that in most of the Mollusca, and, according to Dr. Carpenter, is made up of two very differently constituted portions. The outer or larger part of the shell is cellular, or composed of fibrous material,

placed at right angles to the surface, while the inner is laminated; and as these laminæ are placed in an irregular, or rather in an undulating or wavy manner, they produce the shelly substance called nacre, which, it appears, is more susceptible of destruction than the outer or fibrous portion, and this in many of the secondary fossils is the only part of the shell which is preserved. The fibrous portion being very fragile, the shell separates readily into fragments; and it is, therefore, a fossil not generally found in a perfect condition. There is also another peculiarity in the shell, being, as it were, divided by a line down the middle, from the pedilateral to the siphonilateral margins, where it will readily crack: so that fossils have frequently become of a quadrate form; such, for example, as *Pinna tetragona*, which has assumed that shape from pressure alone. Many of the species of this genus will show, more or less, this tendency to angularity on the outside of the valves. The pearly or nacrous lining seldom extends more than half-way from the beak; frequently not so far. Many of the species attain to large proportions. *Pinna nobilis*, of Poli, an inhabitant of the Mediterranean, has a shell that is said to measure three feet and a half. This genus is as old as the Carboniferous Limestone, or perhaps the Devonian; so far, of course, as can be determined by the shell alone; and it existed through the intermediate periods, though not anywhere in great abundance. One of the aberrant forms found in the Oolites has been thought, by Messrs. Morris and Lycett, to have a difference sufficient to justify a generic separation, and they have adopted for it the name of *Trichites*; the history of which, and the reasons for adoption, are given by these authors in their valuable monograph of the Oolitic Bivalves. The principal difference existing between the Oolitic shell and the true Pinna is in the inequality of the valves.

Pinna is on the verge of the ordinal division; it more strictly belongs to the *Dimyaria*, having two adductor muscles, but one is so near to the pointed extremity of the valves as to be used more as a connector than as an adductor, while the other, the really useful one, is situated quite in the centre of the shell.

1. Pinna affinis, *J. Sowerby*. Tab. X, fig. 1, *a—c*.

Pinna affinis.	*J. Sow.*	Min. Conch., t. 313, fig. 2, 1821.
—	—	*Mantell.* Geol. Tr., 2d series, vol. iii, pt. i, p. 203, 1829.
—	—	*Wetherell.* Phil. Mag. and Journ., vol. ix, p. 464.
—	—	*Nyst.* Foss. Belg., p. 275, 1843.
—	—	*J. Sow.* in Dixon's Geol. Sussex, pp. 31, 117, 172, 226, 1850.
—	—	*Morris.* Cat. Brit. Foss., p. 179, 1854.
—	—	*D'Orbigny.* Prod. de Paléont., t. ii, p. 391, 1850.

Spec. Char. P. testâ cuneatâ, trigonâ, regulari, costatâ; apice acuto; siphoni-regione truncatâ; costis divergentibus; margine dorsali recto, margine ventrali sub-arcuato, simplici.

Shell cuneiform or wedge-shaped, regularly trigonal; apex acute, truncated at the

extremity of the siphonal region, and ornamented with diverging ribs; dorsal margin straight, ventral margin slightly curved.

Length.—9 to 11 inches.

Localities.—Highgate, Whetstone, Chalk Farm (*Wetherell*), Sheppey, Newnham (*Prestwich*), Bognor, (*Edwards*).

Our shell is ornamented with about sixteen or eighteen rather elevated rays or costæ, slightly imbricated, and sometimes undulating, with occasionally a small intermediate ray.

This species appears to have possessed a habit similar to that sometimes seen in species of *Modiola*; two or three specimens are found together, the one enveloping the other. A young fry probably occupies the shell of its parent, which it has never left, and perhaps grows to its full size where it was born, filling entirely with its own shell the one previously occupied by the mother. Mr. Edwards' specimen shows this intimate union of three individuals, each as nearly as possible of the same size. An imperfect specimen of this species in the Museum of the Geological Society indicates a length of twelve inches

2. Pinna arcuata, *J. Sowerby.* Tab. XI, fig. 8.

Pinna arcuata.		*J. Sow.* Min. Conch., t. 313, fig. 3.
—	—	*Prestwich.* Journ. Geol. Soc., 1847, p. 405.
—	—	*Morris.* Catal. Brit. Foss., p. 180, 1854.
—	—	*D'Orbigny.* Prod. de Paléont., t. ii, p. 391, 1850.

"Nearly equilateral, ventricose, finely ribbed, arched."

Longest diameter, $\frac{3}{4}$ths of an inch.

Locality.—Highgate (*J. Sowerby*).

"Nearly as deep as long; the hinge-line is gently curved; the opposite edge much arched; in other respects, this strongly resembles the last."

"Having several specimens of this arched *Pinna* from Highgate, exactly alike as well in curvature as in size, I cannot but consider it a distinct species. It appears to be quite different from *P. incurva*, Linn.: it occurs in *Septaria*." (*Sowerby*).

The figure above referred to, and the description, are taken from 'Min. Conch.'

3. Pinna margaritacea, *Lamarck.* Tab. XI, fig. 9.

Pinna margaritacea.		*Lam.* Ann. du Mus., t. vi, p. 218, and t. ix, t. 17, fig. 8.
—	—	*Defrance.* Dict. des Scien. Nat., t. 41, p. 71.
—	—	*Desh.* Coq. Fos. des Env. de Par., t. i, p. 280, pl. 41, fig. 15.
—	—	*Id.* An. sans Vert. du Bassin de Par., t. ii, p. 35, 1860.
—	—	*Nyst.* Coq. Foss. Belg., p. 274, pl. 20, fig. 9.
—	—	*J. Sow.* in Dixon's Geol. of Sussex, pp. 94, 117, 172, 226.
—	—	*Morris.* Catal. Brit. Foss., p. 180. 1854.

Spec. Char. "*Testâ elongatâ, cuneiformi, trigonâ, angustâ, sublævigatâ, vel sulcis longitudinalibus, superficialibus, undulatis instructâ, extùs fuscâ, fibrosâ, intùs albâ, margaritaceâ.*"

"Shell elongate, wedge-shaped, trigonal, nearly smooth, or with superficial and longitudinally undulating rays, externally brownish or dusky and fibrous, within white and nacreous."

Length, ?

Localities.—Bracklesham (*Dixon*), Highgate (*Sowerby*).

France, Grignon, Parnes (*Desh*).

"This appears to have sharper ribs than *P. affinis*, but probably they are the same species differently preserved." (*J. Sowerby.*)

Our figure is taken from a specimen in the British Museum in the late Mr. Dixon's collection; this species appears to have more numerous and finer rays than any I have seen upon the young state of *P. affinis*.

4. Pinna pyriformis, *S. Wood.* Tab. X, fig. 2, and Tab. XI, fig. 10.

Pinna — n. s. *Prestwich.* Quart. Journ. Geol. Soc., vol. iii, p. 370, 1847.

Spec. Char. P. testâ tenui, tumidâ, inflatâ, infundibuliformi, costatâ; costis numerosis, subundulatis; margine dorsali subrectâ; margine ventrali incurvâ.

Shell thin, tumid, or inflated, funnel-shaped, costated; ribs numerous, thin, and slightly undulating; dorsal margin nearly straight, ventral margin curved.

Length, ?

Locality. Cuffell, near Basingstoke (*Prestwich*).

The specimen figured is from the cabinet of Mr. Prestwich, and I coincide in his opinion that it is specifically distinct; it is unlike any other species that I have seen. It differs from *P. affinis* in form, and it approaches nearer to *P. arcuata;* but it is not so curved as that species, either in the dorsal or ventral margin, and it is considerably more expanded than either of those species. A small portion only of the shell is left, and the rays are nearly obsolete; what there are remaining appear to have been smaller and more numerous, and also more equal, than those of *affinis*, but its presumed distinction is founded upon the expanded character. I cannot but imagine this to be natural, for although there is a tendency in many species of this genus to become inflated by a collapse or fracture in the centre, I do not see in this any angularity, but a regular curvature in the valves.

DREISSENA. *Van Beneden*, 1834.

Mytilus. *Lam.* and *Goldf.*	Congeria. *Partsch*, 1837.
Enocephalus. *Münst.*, 1831.	Mytilomya. *Cantraine*, 1837.
Mytulina. *Cantraine*, 1834.	Mytilimeria. *Conrad*, 1837.
Dythalmia. *Jay*, sec. *Gray*.	Coelogonia. *Bronn* (laps. calam.), 1837.
Tichogonia. *Rossmaesler*, 1835.	Ænocephalus. *Herrm.*, 1846.

Generic Character. Shell equivalve, inequilateral, ovately trigonal or obscurely wedge-shaped; umbones terminal, pointed; hinge edentulous; valves obtusely keeled, with a slight byssal sinus; one muscular impression, immediately beneath the umbones, supported upon a shelf, projecting inwardly; impression of pedal muscle single; anal adductor large, excentric; connexus bipartite.

The animal (*Mytilus polymorphus*) with the mantle closed, except for the foot and byssus. Siphons unequal; anal opening small, conical, and plain; branchial opening prominent and fringed; foot-muscle short and thick.

The name of *Enocephalus* of Münster seems to have priority of date, but, according to M. Bronn, it was merely given to the shell without figure or description; it therefore yields to a subsequent claim, and this is divided between *Mytilina*, Cantraine, and *Dreissena*, Van Beneden; both of which names were proposed for the shell in the same year. Bronn has awarded the right to Van Beneden, who, he says, is entitled to priority. The name is also in general use.

This is a fresh-water mussel; the typical species, *Myt. Volgæ*, Chemn., is a native of the Aralo-Caspian rivers, whence it has been brought to this country on foreign timber, and it has now become naturalised with us. It differs principally from *Mytilus* in having a calcareous plate immediately under the umbo; in other respects it resembles the general form of the mussels. M. Nyst enumerates fourteen species, eight of which are fossil from the Tertiaries of Germany, France, Belgium, and the Crimea; but a fossil said to belong to this genus has been found in the coal measures. The species, though probably more inclined to fresh-water, were capable of living in estuaries where the water was salt.

This, like the genus *Unio*, is very variable in regard to the solidity or substance of the shells of different species; some are thick and heavy, while others are quite the reverse. This is, perhaps, truly Dimyarian, with two adductor muscles, and the animals possess distinct but short siphonal tubes, indicating, by the inflexion in the mantle-mark, probably a slight difference in their extent of protrusion.[1]

[1] *Dreissena* is said to be distinguished from *Mytilus* as much by the intimate structure of the shell as it is by other characters.

DREISSENA BRARDII, *Faujas St. Fond.* Tab. XII, fig. 3, *a—e.*

MOULE. *Fauj. St. Fond.* Ann. du Mus., t. viii, t. 58, figs. 11, 12.
MYTILUS BRARDII. *Brongn.* Terr. calc. Trap. du Vincentin, t. 6, fig. 14, 1823.
— — *Goldf.* Petr. Germ., vol. ii, p. 271, t. 129, fig. 10.
— — *J. Sowerby.* Min. Conch., t. 532, fig. 2, 1826.
— — *Bronn.* Leth. Geog., t. ii, p. 923, pl. 39, fig. 10, 1836.
— — *Nyst.* Rech. Coq. foss. Hoess. et Kl. spaw., p. 13, No. 22, 1836.
?— — var. β ? *Basterot.* Bordeaux Foss., No. 2, p. 78.
?— BASTEROTII. *Dujardin.* Tr. Géol. Soc. Fr., vol ii, p. 269.
?— ACUTIROSTRIS. *Goldf.* Petr. Germ., t. v, pl. 129, fig. 11, p. 272.
?— SPATHULATUS. *Id.* - - fig. 12.
CONGERIA BASTEROTI ? *Desh.* Conch., 650, t. 37, figs. 15, 16.
DREISSENA BRARDII. *Morris.* Catal. Brit. Foss., p. 202, 1854.
— — *Pictet.* Traité de Palæont., pl. 81, fig. 11.
— BASTEROTI. *Nyst.* Conch. Foss. Belg., p. 265, pl. 20, fig. 7 *a—c.*
— SOWERBYI. *D'Orbigny.* Prod. de Palæont., t. 11, p. 425, No. 1637, 1850.

Spec. Char. D. testâ ovatâ vel elongato-cuneatâ; lævigatâ, obtusè carinatâ; umbonibus acutis; septo cochleato.

Shell ovate or elongately wedge-shaped, smooth, and obtusely carinated; beaks sharp and pointed; septum concave.

Length, ⅞ths of an inch.

Localities. Hordwell, Headon Hill (*Forbes*).

Belgium, Limbourg (*Nyst*), Weisenau, Env. de Mayence (*A. Brongniart*).

This little shell is abundant in the fine sandy stratum at Hordwell which has yielded so many beautiful vertebrate fossils. Upwards of a hundred specimens were obtained by myself, congregated in and around the upper jaw of *Alligator Hantoniensis*. It is possible that the decomposition of the flesh of the dead reptile may have rendered the water at that place favorable to the multiplication of the mussel. I found the shell elsewhere, but in no other place in so great abundance.

My specimens are variable in outline; the proportions in some are from $2\frac{1}{2}$ to 1, while in others they are not more than $1\frac{1}{2}$ to 1, the more elongated being also the more tumid. The umbo is a little inflected, and in some specimens there is a flattening on the siphonal region. The shelf is of a moderate size, and is not entirely occupied by the muscle, the mark of which is indented on it, and is of a roundedly oval shape. The cartilaginous portion of the connexus extended about two fifths of the longest diameter of the shell, and, like that of *Mytilus*, it was nearly covered by the dorsal edge. Many specimens of a small *Serpula* (*tennis*) were found with this mussel in association with numerous specimens of Limnææ, Cyrenæ, &c., and in one of the specimens there is what appears to be the arenaceous case of a *Sabella* (fig. 3 *a*). We have, thus, supposed marine animals living in fresh water with Limnææ, or we have the supposed

fresh-water Limnææ in company with salt-water animals, as previously noticed by Mr. James Sowerby in his 'Mineral Conchology.' I am inclined to think the water where these animals were deposited was quite fresh, although Limnææ have been found living in saline marshes; the reptile was probably stopped by a bend of the river or by some impediment in the stream; the presence of a large number of the scales of *Lepidosteus* in this layer of sand indicates the greater probability of its having been more of a fresh-water deposit than brackish.

D. Brardii is given by Mr. Prestwich in his list of the organic remains of the Woolwich and Reading series (Jour. Geol. Soc., 1847, p. 117); he says, however, at p. 120 (*f*)—"this shell is here in too imperfect a state to admit of a positive determination."

Two specimens, with the name of *Mytilus Brardii*, were obligingly sent to me many years ago by the Comte du Chastel, and to these was attached the locality of Bordeaux. I presume they are what have since been called *Dreissena Basterotti*. On a close comparison with the British fossil, these specimens present the following differences: they are rather more pointed, less curved at the umbo, and they have an obtuse elevation or sort of ridge at the most inflated part, which has probably caused them to be called "subcarinated." Whether these slight differences be permanent or whether they are such as will constitute a specific distinction, the few specimens of the Bordeaux shell that I have seen will not permit me to give a decided opinion.

MYTILUS. *Linnæus*, 1758.

Generic Character. Shell equivalve, wedge-shaped, acuminated, rounded on the siphonal side; umbones pointed, terminal; hinge-teeth few, minute, sometimes obsolete; muscular impression at the umbo small and narrow; pedal impressions two in each valve; connexus bipartite, marginal; interior of shell nacreous.

Animal elongate, with the lobes of the mantle partly fringed, plain in the anal region, and slightly projecting; disconnected except where there is a separation for the siphonal openings; adductor muscles very unequal in size; foot cylindrical, furnished with a gland and groove; byssus strong and coarse.

This genus is generally marine, though sometimes estuary in its habits, and, I believe, *M. edulis* is known occasionally to live with Limnææ, &c., when the water is fresh. This common edible mussel frequents mud banks, and, as it is well known, is more often found where it has been deserted by the retiring tide; others inhabit the sea at considerable depths. In the recent state the genus numbers probably fifty species, and these have a very extensive geographical range, taking in the whole circumference of the globe. The generality of the species are extra-tropical. Fossil species are abundant, and are said to be found in rocks of the Permian age.

1. Mytilus affinis, *J. Sowerby*. Tab. XII, fig. 1, *a—d*.

Mytilus affinis. *J. Sow.* Min. Conch., t. 532, fig. 1.
— — *Morris.* Catal. Brit. Foss., p. 215, 1854.

Spec. Char. M. testâ tenui, elongato-cuneatâ vel obliquè-oblongatâ, lævigatâ, subcarinatâ; margine dorsali subrecto; intùs margaritacea; cardine edentato.

Shell thin, elongately wedge-shaped, or obliquely oblong, smooth, subcarinated; hinge-margin nearly straight; interior pearly; hinge without teeth.

Length, 2 inches.

Localities. b, Barton; *a*, *c*, *d*, Colwell Bay, Headon Hill, Whitecliff Bay, Hordwell (*Edwards*).

This species much resembles in outline some of the varieties of the common mussel, but it is carinated, that is to say, it is obtusely ridged at the most tumid or inflated part, and it is generally less rounded and more flattened in the siphonal region than in the recent British species; it is also very thin, and quite free from teeth at the umbo. Although not abundant, this fossil presents a good deal of variation in outline, the dorsal margin being much longer in some specimens than in others; but this kind of variability is common to the genus, and it may be seen in excess in the varieties of *M. edulis*.

2. Mytilus strigillatus, *S. Wood*. Tab. XII, fig. 2, *a*, *b*.

Spec. Char. M. testâ minimâ, tenui, ovato-cuneatâ, obliquâ, incurvâ, inflatâ, radiatim striatâ, striis obtusis convexis; margine dorsali arcuatâ, et crenulatâ; margine ventrali subincurvâ; areâ cardinali denticulatâ.

Shell small, thin, and ovately wedge-shaped, oblique, incurved, tumid, radiately striated; striæ obtuse, rounded; dorsal margin arched and strongly crenulated; ventral margin slightly concave; hinge-area denticulated.

Length, $\frac{1}{4}$ inch.

Locality. Barton (*Edwards*).

Half a dozen specimens of this pretty little shell appear to offer good distinguishing characters. The connexus was short, and situated within the rounded dorsal margin, but its action was over a fulcrum, and it was probably visible when the valves were closed. There are about half a dozen denticles in the hinge-area, variable in size, the two on the pedal side being the larger, and the dorsal margin outside the ligament is strongly denticulated, like *Modiolarca*. The striæ, or rather ribs which ornament the shell, are large, prominent, and rounded, not angular, and the spaces between them are as broad as the ribs; an intermediate ray may be occasionally seen on the dorsal and siphonal regions as the shell enlarges. This closely approaches *Modiola*, having a trifling extension beyond the umbo.

MODIOLA. *Lamarck*, 1801.

Generic Character. Shell equivalve, inequilateral, irregularly and roundedly oblong or trapezoidal; valves sometimes smooth, sometimes entirely covered with radiating striæ, at others the central portion is smooth, with the lateral extremities striated; pedal region small, umbones subterminal; hinge-margin generally smooth, sometimes crenulated, edentulous; connexus bipartite; impressions of the adductors unequal; shell slightly gaping for the passage of a byssus; epidermis in the recent state often produced into long, beard-like fringes; interior of shell nacreous.

Animal with the margins of the mantle without fringe; foot cylindrical, elongated; spins generally a fine and ample byssus.

This is, as it were, an emanation from the last, with a further approach towards the true Dimyaria. Unlike the preceding, in which the umbo is pointed and terminal, the animals of this genus extend their shells beyond the beak on the pedal side, altering their form from the wedge-shape of *Mytilus* to the sub-rhomboidal shape of this. In *Mytilus* the oral adductor is immediately beneath the umbo, but in this genus it is beyond it, and on the inner side of the cartilaginous portion of the connexus there is generally a deeply impressed mark of the pedal muscle.

The habits of these animals in the living state are variable; many of the species spin a byssus, by which they are constantly fixed, and this byssus in some is so enlarged as to envelop the shell in a kind of nest; others bore into the test of an Ascidian; while for some cylindrically formed shells, such as *M. lithophagus*, Linn., a habitation is excavated in corals, shells, and the hardest limestone rocks; these latter, from such habits and their cylindrical form, have by some naturalists been considered as entitled to a distinct generic position (*Lithodomus*, Cuv.). These boring shells are found in the Oolites, in the thick shells of *Trichites* and *Astarte*, as well as in the rock itself, and shells resembling them have been met with in the Palæozoic formations.

Crenella is another section of this genus which has been put forward as a claimant for isolation; the principal, perhaps the only, distinction is the striation of the exterior, but this in itself is insufficient. Shells included in the above diagnosis possess every possible variation. In some the shell is quite smooth or naked, but in others it is less than half ornamented, increasing the extension in striation until many are entirely covered; while some have the centre smooth, with the extremities striated. This, again, is in one species reversed, the striæ only occupying the central portion.

Myopara is a name proposed as a genus by Lea in substitution of *Stalagmium*, Conrad, 1833 (Morton's 'Synopsis,' App., p. 8), for the reception of a small Eocene fossil of America, which is possibly an aberrant form of this genus, as suggested by Mr. Woodward, belonging to the section *Crenella*. It is of a more ovate outline than are the generality

of the species of this genus; it resembles *Mytilus decussatus*, Montague, which Brown made the type of his genus *Crenella*. This small and apparently rare shell of Lea is the only recorded fossil of the Eocene period belonging to the Mytiloid family from the American beds that I am acquainted with. A few small species from the Paris basin have been recently figured and described by M. Deshayes under the generic name of *Crenella*. These French fossils have a more rounded form than any of our English species.

Modiola is generally a marine genus, and it is found in most parts of the world, and at various depths; two or three species have, however, been found in estuaries and where the water is sometimes fresh. Mr. McAndrew gives the vertical range of *M. modiolus* from the shore to 100 fathoms.

1. Modiola depressa, *J. Sowerby*. Tab. XII, fig. 4.

Modiola depressa.	*J. Sow.*	Min. Conch., t. 8, three upper figs., 1812.
—	—	*Prestwich.* Proc. Geol. Soc., May, 1847, p. 404.
—	—	*J. Morris.* Catal. Brit. Foss., p. 211, 1854.
—	—	*Smith.* Strat. Syst. Org. Foss. Lond. Clay, p. 2.

Spec. Char. M. testâ tenui, elongatâ, obtusè-cuneatâ aut irregulariter trapeziformi, compressâ, lævigatâ; umbonibus minutis, depressis, subterminalibus; pedi-regione brevi, siphoni-regione elongatâ et latiore; margine ventrali subrectâ.

Shell thin, elongate, obtusely wedge-shaped or irregularly trapeziform, compressed, smooth; umbones small, depressed, and nearly terminal; pedal region short and rounded; siphonal region long and broad; ventral margin nearly straight.

Length, 2 inches.

Localities. Highgate (*Sowerby*), Sonning Hill (*Prestwich*).

"This shell is two and a half as broad as it is long, and thin; the margin even and very regularly curved; it is altogether very flat, particularly so at the anterior (?) side: the beaks are very slightly prominent and are rounded; lines of growth faint; external coat shining and pellucid, internal pearly. It is difficult to preserve, that being so extremely tender, the clay shrinks in drying, the shells crack and scale off in pieces, else the appearance of an epidermis is almost to be recognised." (*J. Sowerby.*)

Specimens of a shell strongly resembling this from Harwich, as also from the Barn Rock, near Bognor, and from Hollyport, are in the Museum of the Geological Society, but they are not perfect enough for fair determination.

2. Modiola Deshayesii, *J. Sowerby*. Tab. XIII, fig. 14, *a*, *b*.

Lithodomus Deshayesii. *J. Sow.* in Dixon's Geol. of Sussex, pp. 94, 171. t. 2, fig. 28.
— — *Morris*. Catal. Brit. Foss., p. 207, 1854.
Modiola lithophaga. *Desh.* Coq. Foss. des Env. de Par., t. i. p. 267, t. 38, figs. 10—12.
— — *Pictet*. Traité de Palæont., vol. iii, p. 584, pl. 81, fig. 9.
Mytilus lithophagus. *Desh.* Trait. Element, t. 37, figs. 5, 6.
Lythodomus sublithophagus. *D'Orb.* Prod. Palæont., p. 391, No. 1083.
— — *Bellardi*. Catal. Ragion. dei. foss. Numm. d'Egitto, p. 26, No. 62, 1854.
Modiola Deshayesii. *Desh.* An. sans Vert. du Bassin de Par., t. ii, p. 18, 1860.

Spec. Char. M. "*testâ elongatâ cylindraceâ, rectâ; anticè tumidiore; extremitatibus obtusis; striis longitudinalibus posticè brevibus; striis transversis irregularibus, decussatis.*"

Length, 1 inch.

Localities. Bracklesham (*Dixon*).

France, Parnes, Chaumont (*Desh.*), Egypt, Sinde (*Bellardi*).

The figure above referred to is a copy of the one in Mr. Dixon's work. The specimen cannot now be found.

The Paris basin shell, when first described, was doubtfully considered to be a variety of the existing species, under which name it was then published. M. Deshayes, in his 'Hist. des An. sans Vert. du Bassin de Paris,' p. 18, has adopted the above specific one, which was given to it by Mr. Jas. Sowerby, who considered it sufficiently different to be entitled to a distinct position, and M. Deshayes is now of the same opinion. I regret not having been able to see the British fossil.

3. Modiola dimidiata, *S. Wood*. Tab. XIII, fig. 5.

Spec. Char. M. testâ tenui, depressâ, subcylindraceâ, elongatâ; pedi-regione brevi, rotundatâ, valdè inæquilaterali; dimidiatim radiatâ, umbonibus depressis; margine ventrali rectiusculo.

Shell thin, depressed, nearly cylindrical, elongate; pedal region short, rounded; one half of the shell striated or rayed, the other smooth or naked; ventral margin nearly straight.

Length, $\frac{7}{8}$ths of an inch.

Locality. Highcliff, Barton (*Edwards*).

I have seen only a single specimen of this elegant species, but it is well marked; it approaches the cylindrical and stone-eating shells called *Lithodomus*. The striæ cut the shell diagonally into two nearly equal parts, covering the whole of the siphonal region and extending from the umbo to the extremity of the margin, the other half of the shell is free from these markings, with the exception of the extreme margin on the pedal side, which has a few rays or ridges.

This species much resembles *M. Bernayi*, Desh. (An. sans Vert. du Bassin de Paris, t. 11, p. 13, Pl. 74, figs. 13—16), particularly in the outline, but it differs in having a smaller pedal region. Our shell is ornamented between the rays on the siphonal region with elevated ridges or regular lines of growth, decussating, as it were, the interspaces.

Fig. 15 is the cast of a shell in the late Mr. Dixon's collection of Eocene fossils in the British Museum; unfortunately it is without a locality. It resembles in outline the above species.

4. Modiola dorsata, *Morris*. Tab. XIII, fig. 2.

Modiola dorsata. *Morris*. Geol. Journ., vol. x, pt. i, p. 158, pl. 11, fig. 14, 1854.

"A rare species. The specimen is hardly sufficiently perfect for an exact determination of its characters. It differs from the preceding species (*M. Mitchelli*) in the umbo not being so terminal, and the form being less spathulate and more compressed." (*Morris*.)

Locality. Sundridge (*Prestwich*).

The only specimen that I have seen is the one figured, and I am unable to add to the description given by the proposer of the species. The prominent diagonal ridge is probably accidental, but the pedal side is considerably extended, if it be natural and not forced out by pressure.

5. Modiola elegans, *J. Sowerby*. Tab. XII, fig. 5, *a*—*c*.

Modiola elegans. *J. Sow*. Min. Conch., t. ix, left-hand figures.
— — *J. Morris*. Catal. Brit. Foss., p. 211, 1854.
Mytilus elegans. *D'Orbigny*. Prod. de Paléont., p. 391, 1850.

Spec. Char. Testâ tenui, ovato-elongatâ vel subtrapezoidali, tumidâ, subcarinatâ; pedi-regione brevi, siphoni-regione rotundâ; margine dorsali paulo angulato; striis utroque divaricatis, spatio mediano lævigato; margine ventrali subrecto.

Shell thin, elongately ovate or subtrapezoidal, tumid, and obtusely keeled; pedal region short and rounded; dorsal margin obtusely angulated or curved; striæ on both sides divergent, middle plain; ventral margin slightly contracted; shell nacreous.

Length, $1\frac{1}{4}$ inch.

Localities. *a*, Highgate (*Wetherell*), Bognor, Richmond Park (*J. Sowerby*), Clewer Green? (*Prestwich*); *c*, Bracklesham, Barton (*Edwards*); *b*, Hordwell (*Edwards*).

This appears to have extended from the lowest to the uppermost of the Eocene deposits; it is not rare, and is subject to considerable variation. It is less pointed on the pedal side than *M. hastata*. Our shell is thin, and some specimens are so irregularly tumid as to form an obtuse keel or ridge from the umbo to the edge of the ventral margin of the siphonal region, but in others this is by no means prominent, as if this keel were

in some degree accidental. The striæ on the siphonal region of the shell extend over more than half the surface, and those upon the pedal region are few and faint, sometimes obsolete. Mr. Sowerby speaks of a denticulated margin and a dentated hinge (note, p. 32, Min. Conch.), and says that it is very abundant at Highgate. In the specimens from Bracklesham the ridges or rays are small, with broad interspaces; in those from Highgate the ridges are about the same breadth as the interspaces; those from Bramshaw have broad, flat ridges, with only narrow lines of separation, the Highgate specimens being intermediate. Casts of this or of some proximate species found at Harwich are in the Museum of the Geological Society.

There are three different forms which I have figured, considering them all to belong to the same species, from my inability to draw a line of distinction between them. Among the Highgate specimens elongated as well as abbreviated specimens may be seen; fig. 5 *a* looks like a distortion.

6. Modiola eximia, *S. Wood.* Pl. XIII, fig. 6, *a*, *b*.

Spec. Char. M. testâ minimâ, ovato-elliptică, obliquâ, valdè inæquilaterali, pedi-regione brevi, rotundatâ; siphoni-regione latiore; spatio submediano parvo, lævigato; striis tenuibus, exilissimis; margine ventrali arcuato.

Shell small, ovately elliptical, oblique, very inequilateral; pedal region small, short, and rounded; siphonal region broader; central region free from striæ, ventral margin rounded.

Length, $\frac{1}{10}$th of an inch.

Locality. Highcliff, Barton (*Edwards*).

A specimen of each valve of this elegant little shell is in the cabinet of Mr. Edwards, and these are all that I have seen. I imagine them to be full grown, as the muscular markings are deeply seated; the anal adductor impression is large, of an ovate form, and situated a little beyond the hinge-line; the one in the pedal region is about half the size, situated near the umbo; the two are connected by a distinct mantle-mark. The striæ cover the surface of the shell, excepting a small space on the pedal side of the ventral region; this naked space occupies about one fourth of the surface, and it is less, comparatively, than upon any of our larger species covered with this kind of ornament. This character more especially, as well as a difference in outline, will, I consider, distinguish it from the fry or young of any other species with which it was associated. The inner margin of our shell is crenulated all round, excepting the small space in the ventral region; the crenulations on the pedal side are few and large. The umbo is moderately elevated, and the shell, for its size, appears to be strong.

7. Modiola flabellula, *S. Wood.* Tab. XIII, fig. 9, *a—c.*

Spec. Char. M. testâ tenui, elongatâ, irregulariter trapeziformi; pedi-regione parvâ, brevi; siphoni-regione elongatâ et latiore; radiato-costulatâ, costulis magnis, depressis, aliquando dichotomis; margine ventrali subsinuato.

Shell thin, elongate, irregularly trapeziform; pedal region small and short; siphonal region elongate and broader; radiately rayed with broad, depressed ribs or riblets, which sometimes divide or bifurcate; ventral margin slightly curved.

Length, 1 inch.

Locality. Hempstead (*Edwards*).

Three specimens of this shell have lately come into the possession of Mr. Edwards, and I think they are entitled to be considered as belonging to a distinct species. The shell is different from *M. nodulifera* in its more elongated form and in the radiations not being noduliferous. *M. pectinata*, Lamarck, approaches it in some characters, but the outline is different, and that shell has more numerous radiations.

8. Modiola hastata, *Deshayes.* Tab. XII, fig. 6, *a*, *b*.

Modiola hastata.	*Desh.* Coq. Foss. des Env. de Par., t. i, p. 361, pl. 38, figs. 13, 14, 1824.
—	—	*Id.* An. sans Vert. du Bassin de Par., t. ii, p. 13, 1860.
—	elegans.	*J. Sow.*, in Dixon's Geol. of Suss., p. 94, pl. 44, fig. 13, 1850.
Mytilus hastatus.		*Desh.* Ency. Méthod. Vers., t. ii, p. 563, 1830.

Spec. Char. M. testâ ovato-elongatâ, subulatâ, valdè recurvâ; dorso obliquè angulatâ; striatâ; striis divaricatis, spatio mediano lævigato; pedi-regione brevi, profundè crenulatâ.

Shell ovately elongate, tapering, greatly recurved; dorsal margin obliquely angular; striated striæ divaricating; central space smooth; pedal region short, pointed; margin deeply crenulated.

Length, 1¾ inch.

Localities. Brook (*Edwards*), Bognor.

There is a considerable curvature in the ventral margin of this species, and the shell is elevated into an obtuse keel curving from the umbo; in these characters it differs from *M. elegans*, and it appears to be identical with the Paris basin species. The whole of the siphonal region is deeply and coarsely striated; these striæ bifurcate towards the siphoni-lateral margin, and extend a little over the obtuse keel or ridge, beyond which they immediately become finer, and are soon lost in the naked ventral region. The pedal region is very small, angular, or obtusely pointed, and on the margin of this are a few coarse, radiating striæ or ridges. The ventral region is strongly marked with lines of growth.

9. Modiola Mitchelli, *Morris*. Tab. XIII, fig. 10.

Modiola Mitchelli. *Morris*. Geol. Journ., vol. x, pt. 1, p. 158, t. 2, figs. 12, 13, 1854.
— — *Id.* Catal. Brit. Foss., p. 211, 1854.

Spec. Char. "*M. testâ tenui, lævi, subtrigonâ, anticè obtusâ, posticè dilatatâ; cardine marginali recto.*"

"A somewhat trigonal, depressed, and dilated shell, with the umbones obtuse, the dorsal line straight, the byssal margin nearly straight or but very slightly curved, the surface nearly smooth or faintly marked by lines of growth." (*Morris.*)

Length, 1 inch.

Localities. New Cross, Deptford, Lee and Blackheath (*Morris*).

"This species is near to *Dreissena antiqua, Mell.*, but the dorsal margin is more produced, and the general character of the shell more spatulate."

"Not rare in the upper part of the Woolwich series, but it is rarely found perfect." Mr. Prestwich's cabinet.

10. Modiola nodulifera, *S. Wood*. Tab. XIII, fig. 8, *a*, *b*.

Spec. Char. M. testâ tenui, irregulariter trapeziformi, valdè inæquilaterali; pedi-regione parvâ, margine subrotundatâ, siphoni-regione magnâ, dilatatâ; extùs radiatim striatâ, striis magnis, bifurcatis, noduliferis; margine ventrali incurvâ.

Shell thin, irregularly trapeziform, very inequilateral; the pedal region small and rounded, siphonal region expanded, covered with large, birfurcating, and nodulous radiations; ventral margin somewhat curved.

Length, $\frac{1}{2}$ an inch.

Locality. Barton (*Edwards*).

One specimen is all that I have seen, but its ornamentation is so different from that of any other species that I think it must be distinct. The striæ which cover the entire surface are peculiar in bifurcating at a very early period. Near the umbo they do not amount to more than half a dozen, while at the outer margin of the siphonal region as many as thirty-five may be counted; these striæ are rather broader than the intermediate spaces, and they are ornamented with a small knob or thickening at regular distances.

11. Modiola Nystii, *Kickx*, MSS., sec. *Nyst*. Tab. XII, fig. 8, *a*, *b*.

Mytilus Nystii. *Nyst*. Coq. Foss. Belg., p. 270, pl. 20, fig. 8 *b*.
— — *Id.* Rech. Coq. Foss. de Hoesselt et Kl. Spau., p. 14, No. 35, pl. 3, fig. 35, fide Nyst.
— hastatus. *Goldf.* Petr. Germ., p. 179, pl. 131, fig. 13.

Spec. Char. M. testâ elongato-ovatâ, obliquâ, incurvâ, striatâ; striis numerosis, radiantibus, divaricatis, spatio mediano lævigato; pedi-regione brevi, margine rotundato, crenulato; regione dorsali subarcuato.

Shell elongately ovate, oblique, incurved, striated; striæ numerous, radiating, and divaricating; middle portion smooth; pedal region short, with rounded and crenulated margin; hinge-line somewhat arched.

Length, 2 inches.

Localities. Brockenhurst (*Edwards*).

Belgium, Hoesselt (*Nyst*).

This does not appear to be rare in England.

I agree in opinion with M. Nyst, that this is quite distinct from *M. hastata*, Desh., but that it is the one so called by Goldfuss. Our shell agrees precisely with the Belgian fossil. This appears to be intermediate in form between *M. elegans* and *M. hastata*; it has a greater curvature in the ventral region than that of the former, but less so than in the latter, and it attains to a greater magnitude than either. The rays multiply upon the older portion of the shell, having there double the number that there are upon the younger shell. The ventral region is free from rays, and the hinge appears to possess two or three teeth. These are wholly irrespective of the denticulated margin produced by the few coarse rays which cover the pedal region.

12. Modiola Prestwichii, *Morris*. Tab. XIII, fig. 7.

Modiola Prestwichii. *Morris*. Mem. Geol. Surv., pp. 46, 147, t. 2, fig. 5, 1856.
— Nystiana. *Forbes*. Ut supra (name only).
— — *Morris*. Catal. Brit. Foss., p. 211, 1854.

Spec. Char. "*M. testâ ovato-elongatâ, angustâ, subdepressâ, supernè dilatatâ, longitudinaliter striatâ; striis numerosis obscuris, margine crenulato?*"

"An ovate, elongate shell, of somewhat spathulate form, marked with numerous radiating but rather obscure striæ." (*Morris.*)

Length, 1 inch.

Locality. Hempstead Cliff (*Morris*).

The name of *Nystiana* was originally given to this species by the late Prof. E. Forbes, as written upon the plate above referred to. There was, however, no description appended, and the specific name having been already used in this genus, the describer considered himself justified in revoking the one first imposed, and I have for the same reason followed his example.

A mass of clay in Mr. Edwards's cabinet, with a surface an inch and a half square, has not less than twelve specimens of various sizes upon it, with the exterior upwards, and it is somewhat singular they should all lie in that position; they appear to be single valves.

With them are numerous specimens of a species of *Hydrobia*, from which I should imagine it to be an estuary species. The exterior is covered with exceedingly fine striæ, those on the siphonal region being rather larger and more distant, and the pedal side of the ventral margin is slightly contracted, giving a gentle curvature to the base. The hinge-line is straight, and extends half the length of the shell. The pedal region occupies about one fifth of the specimen.

13. Modiola pygmæa, *S. Wood.* Pl. XIII, fig. 4, *a*, *b*.

Spec Char. M. testâ minutâ, oblongo-ellipticâ, tenuissimâ, tumidâ, striatâ, striis in medio interruptis; pedi-regione parvâ, subacutâ, angustiore; margine dorsali subangulatâ; margine ventrali subrectâ.

Shell minute, elliptically oblong, very thin, tumid, striated, with a small, naked space in the ventral region; pedal region small, pointed; dorsal margin obtusely angulated; ventral margin nearly straight.

Length, $\frac{1}{12}$th of an inch.

Locality. Barton (*Edwards*).

This small and elegant little shell differs from *M. eximia* in the outline, and also in the striation. The exterior is covered with striæ, except on a small space of the ventral region, which is naked. The contour of this species is less rounded than that of *eximia*, and the striæ are fewer and broader. The dorsal edge is covered with crenulations, like those on the so-called *Modiolarca*, but these are merely extensions of the prominent rays which project at the margin.

14. Modiola semi-nuda, *Deshayes.* Tab. XIII, fig. 1, *a*, *b*.

Modiola semi-nuda.	*Desh.*	Coq. Foss. des Env. de Par., t. i, p. 264, pl. 39, figs. 20—22.
—	—	*Morris.* Catal. Brit. Foss., p. 211, 1854.
—	—	*Desh.* An. sans Vert. du Bassin de Par., t. ii, p. 12, 1860.
Mytilus semi-nudus.	*Desh.*	Ency. Méth. Vers., t. ii, p. 569, No. 36, 1850.
—	—	*D'Orbigny.* Prod. de Paléont., t. ii, p. 424, No. 1634, 1850.

Spec. Char. M. testâ ovato-ellipticâ, cordatâ, tumidâ, tenuissimâ, fragili, striatâ; striis exilissimis ornatâ; spatio submediano lævigato; umbonibus minimis, depressis, subterminalibus.

Shell ovately elliptical, heart-shaped, inflated, very thin and fragile, ornamented with very fine striæ; centre portion plain, or free from radiating ridges; umbones small, depressed, and nearly terminal.

Length, $\frac{3}{4}$ths of an inch; *height*, $\frac{1}{2}$ an inch.

Localities. Barton (*Edwards*).

France, Senlis, Grignon (*Deshayes*).

This is an extremely delicate shell, and very rare; a few specimens, however, are quite perfect, and will bear a fair comparison. The shell to which it most nearly approaches is the common British species, *M. marmorata*, but it differs essentially in several characters; these have been pointed out by M. Deshayes, the founder of the present species. The British fossil appears to correspond with the French shell, so far as dependence can be placed upon figures and descriptions, and I have not been able to see a specimen of the latter. The striæ on the pedal region are very large or broad, becoming narrower towards the central smooth space, where they terminate with two or three very fine lines; the radiations on the siphonal region are not so broad; all the rays are flat, with narrow depressions between them. The smooth or naked central space occupies about one third of the surface of the shell, and the lines of growth are here distinctly visible, sometimes raised almost to ridges. The rays on both regions of the French shell are represented of the same size, but they are not so on ours.

One of Mr. Edwards's specimens has enclosed within its valves no less than three others, enveloping one another; one of these enveloped specimens is in a reversed position.

15. Modiola simplex, *J. Sowerby*. Tab. XII, fig. 7, *a*, *b*.

Modiola simplex.	*J. Sow.*,	in Dixon's Geol. of Suss., pp. 117, 225, t. 14, fig. 16, 1850.
—	—	*Morris*. Catal. Brit. Foss., p. 212, 1854.

Spec. Char. M. testâ tenui, elongatâ, obtusè cuneatà vel subtrapeziformi, lævigatâ; umbonibus minutis, depressis, subterminalibus; pedi-regione brevi, contractâ; siphoni-regione latiore, compressâ; margine dorsali rectâ, extensâ.

Shell thin, elongated, obtusely wedge-shaped or obtusely trapeziform, smooth: beaks small, depressed, nearly terminal; pedal region very small and narrow; siphonal region broad and compressed; dorsal margin straight and extended.

Length, $1\frac{3}{4}$ inch.

Localities. Bognor and Herne Bay (*Edwards*).

Mr. Sowerby says, "It is like *M. depressa* of 'Min. Conch.,' but is more pointed."

There appears also to be a little difference in outline; the dorsal margin is less curved and more extended, and the siphonal region is rather more compressed.

16. Modiola subcarinata, *Lamarck*. Tab. XII, fig. 9.

Modiola subcarinata.	*Lam.*	Ann. du Mus., t. vi, p. 222; and t. ix, pl. 17, fig. 10 *a*, *b*.
—	—	*J. Sowerby*. Min. Conch., pl. 210, fig. 1, 1818.
—	—	*Desh.* Coq. Foss. des Env. de Par., t. i, p. 256, pl. 39, figs. 4, 5.
—	—	*Morris*. Catal. Brit. Foss., p, 212, 1854.
—	—	*Desh.* An. s. Vert. du Bassin de Par., t. ii, p. 25, 1860.
Mytilus	—	*D'Archiac*. Foss. du gr. numm. dans Mém. de la Soc. Géol. de Fr., 2 sér., t. iii, pp. 433, 453, 1850.

Spec. Char. M. testâ tenui, ovato-oblongâ, obliquâ, gibbosâ, lævigatâ, subcarinatâ, valdè inæquilaterali, siphoni-regione latiore; margine ventrali incurvatâ, margine dorsali convexiusculâ; striis accretionis notatâ.

Shell thin, ovately oblong, oblique, gibbous, smooth or with visible lines of growth, subcarinated; very inæquilateral, with siphonal region the broader; ventral and dorsal margins curved, but not parallel.

Length, 2 inches.

Localities. Highgate (*Wetherell*), Newnham? (*Prestwich*).

Mr. Sowerby, in 'Min. Conch.' above referred to, considers this as doubtfully identical with the Paris basin shell, but thinks it probable it may be the same as *M. modiolus* of Brocchi.

In the first part of 'Coq. foss. des Env. de Par., t. i, p. 256, M. Deshayes has rejected the British fossil from among his synonyms on account of its dissemblance, but he has admitted it with a mark of doubt in his second part (Descr. des An. s. Vert., t. 2, p. 25). I am unable to throw any light upon this disputed point, and have therefore left it with the name originally given by Mr. Sowerby, but I fully agree with the French author that it cannot be united to *M. modiolus*, Linn. M. Deshayes says his shell very closely resembles an oriental species which Mr. Hanley has named *Modiola Metcalfei*, except that in the recent shell the dorsal edge is more elongated; but it is not so in our fossil, which bears a very strong resemblance to the Indian shell, and I think it probable the three may be united under one name. There is in the recent British species and Crag fossil, *M. modiolus*, considerable variation, more so than is exhibited between the Eocene fossil and the Indian species.

17. Modiola sulcata, *Lamarck*. Tab. XIII, fig. 11.

Modiola sulcata.	*Lam.* Ann. du Mus., t. vi, p. 222; and t. ix, pl. 17, fig. 11 *a*, *b*.
—	—	*Desh.* Coq. foss. des Env. de Par., t. i, p. 258, t. 39, figs. 9, 10.
—	—	*Morris.* Catal. Brit. Foss., p. 212, 1854.
—	—	*Desh.* An. sans Vert. du Bassin de Par., t. ii, p. 15, 1860.
Mytilus sulcatus.	*Desh.* Ency. Méth. Vers., t. iii, p. 566, No. 26, 1830.

Spec. Char. "*Testâ elongatâ, spathulatâ, obliquâ, depressâ, anticè posticèque longitudinaliter sulcatâ, in medio lævigatâ; umbonibus minimis; margine antico brevissimo, crenulato.*"

Shell elongate, spathulate, oblique, depressed, both sides striated or radiated; central portion smooth; umbones small; anterior margin (pedal region) very short, crenulated.

Length, $\frac{3}{4}$ths of an inch.

Localities. Barton (*Edwards*).

France, Grignon, Parnes (*Deshayes*).

There is a single specimen only of this species in Mr. Edwards's cabinet, and this unfortunately is not in very perfect condition, but the figure is faithful, though a little improved. Our shell strongly resembles the figure and description of the French fossil above referred to, and I think it may be safely considered as belonging to that species. A recent species has this name, but it is quite distinct. M. Deshayes says the fossil is entitled to priority.

18. Modiola tenuistriata, *Melleville.* Tab. XIII, fig. 3.

Modiola tenuistriata. *Mellev.* Mém. sur les Sab. Tert. Inf. du Bass. de Par. (Ann. des Sc. Géol., 1843), p. 39, pl. 2, figs. 17—19; and pl. 3, figs. 9, 10.

Spec. Char. M. testâ ovato-elliptică, tumidâ, tenui, fragili, utroque pariter rotundatâ, pedi-regione parvâ; superficie omnino striatâ, striis tenuissimis, radiantibus; striis incrementi elevatis, decussatis.

Shell ovately elliptical, tumid or deep, thin, and fragile, equally rounded at both extremities; exterior wholly covered with striæ; radiating lines fine and thin, decussated by elevated lines of growth.

Length, $\frac{7}{8}$ths of an inch.

Locality. Barton (*Edwards*).

This elegant shell is very rare as a British fossil, and of extreme tenuity. M. Melleville gives two figures of his species, presenting considerable diversity of character. The British fossil corresponds more closely with his figures 9 and 10, pl. iii, both in the outline and ornament. Our shell has the umbo almost at the extremity, and very slightly projecting. The fine, radiating striæ are regularly cut by lines of growth, making the shell appear as if punctured or cancellated.

19. Modiola? tubicola, *S. Wood.* Tab. XIII, fig. 12, *a*, *b*.

Spec. Char. M. testâ subcylindraceâ, lævigatâ, tenui, valdè inæquilaterali; marginibus dorsali et ventrali subparallelis; pedi-regione parvâ, rotundatâ; siphoni-regione compressâ.

Shell subcylindrical, smooth and thin; dorsal and ventral margin nearly parallel; very inequilateral; pedal region small and rounded; siphonal region compressed.

Length, $\frac{5}{8}$ths of an inch; *height*, $\frac{1}{3}$th.

Locality. Whetstone?

In the museum in Jermyn Street is a specimen of the matrix of London Clay with several tubes of the *Teredo*, and located with them are two or three individuals of a *Modiola?*; these latter have apparently taken their abode in the hollow of the tubes. The

specimens are unfortunately not very perfect, but a portion of the shell is visible on one of them; this appears to have been quite smooth and free from striæ of any kind. Assuming this cylindrical state to be the true character of the shell, it resembles that section of the genus called *Lithodomus*, but whether this form be produced from a confined position it is difficult to say. Unlike the generality of the cylindrical species, the siphonal region of our shell, if not distorted, is much compressed, and the margins are quite closed.

This species somewhat resembles *M. angusta*, Desh. (Coq. foss. des Env. de Par., t 1, p. 266, pl. 41, figs. 6—8), but it differs in having the umbo terminal, and our shell is much more unequally tumid. The locality is unfortunately not known.

20. Modiola undulata, *S. Wood.* Tab. XIII, fig. 13, *a*, *b*.

Spec. Char. M. testâ tenui, depressâ, elongato-cuneatâ; siphoni-regione latiore, depressâ; extùs lævigatâ, undulatâ.

Shell thin, depressed, elongately wedge-shaped; siphonal region broad, depressed; externally smooth, and undulating.

Length, 2 inches.

Localities. Harwich and Bawdsey.

There are two specimens of Septaria in the Museum of the Geological Society, marked respectively Nos. 8290 and 15314, presented by the Rev. J. Holmes, to which are attached the above localities; they bear the impressions and the greater part of the shell of a few specimens of a species of *Modiola*, but in a compressed and mutilated condition; they are, however, sufficiently perfect to show, by their lines of growth, that they most probably belonged to a species quite distinct from any other Eocene form, or at least from any that I am acquainted with. The undulations of the exterior do not look as if they could have been produced by compression or accident.

The entire figure (*b*) is a restoration.

Tab. X, fig. 5, represents the fragment of a shell which appears to belong to this genus, and the ornamentation is so peculiar that I think it deserves to be represented in order to call attention to its existence It is from Highcliff, Barton, and is in Mr. Edwards's cabinet. The striæ, or rather costæ, which cover the dorsal portion of the siphonal region, are few and very large, differing from those upon the other part of the shell, from which character it might be called *diversa*. Some species have the striæ of the same magnitude all over the surface, in others the striæ are smaller or narrower on the dorsal portion of the siphonal region, and this diversity is, I think, a good mark of distinction.

21. Modiola Bartonensis, *S. Wood.* Tab. XIX, fig. 18.

A small specimen of a Modiola, of which the figure above referred to is a representation, has very recently come into Mr. Edwards's possession. It is not in a state of preservation sufficient for full and fair description, and I have proposed the above name provisionally. It appears to be covered entirely with large rays or costulæ; it is more elongated than the fragment figured at fig. 5, Tab. X, and it has not the diversified rays which ornament that shell.

22. Modiola (?) crassistriata, *Edwards*, MS. Tab. XIX, fig. 16.

Spec. Char. M. testâ parvâ, ovato-trigonulâ, tenui, siphoni-regione depressiusculâ, radiatim costellatâ aut crassistriatâ; costellis vel striis rotundatis, dichotomis; umbonibus minimis, subterminalibus; margine cardinali subrecto.

Shell small, ovately triangular, thin; siphonal region somewhat depressed, covered with thick radiations or riblets, rounded and bifurcating; beaks small, nearly terminal; dorsal area straight.

Length, $\frac{1}{2}$ an inch.

Locality. Bracklesham (*Edwards*).

The specimen above described has recently been added to the cabinet of Mr. Edwards, and I have considered it, as Mr. Edwards has done, a distinct species. It differs from both of the previously described coarsely striated species, *flabellula* and *nodulifera*, being much shorter than the former, with the striæ or riblets somewhat finer; and from the latter, with which it agrees in form, it differs in not having the nodules of that species. Our present specimen is a pretty shell, and the rays with which it is ornamented are rounded, the spaces between them rather narrow, or at least they are less so than the rays themselves. The specimen adheres too closely to the matrix to permit of a removal, and the interior is entirely hidden. It bears some resemblance to *M. pectinata*, Lam. (Desh., 'Coq. foss. des Env. de Par.,' t. 1, p. 259, pl. 39, figs. 6—8), but our shell is shorter, more angulated, with a comparatively longer dorsal area, and the striæ are coarser.

The umbo in this is nearly terminal, with a very trifling projection of the pedal region; there is an uncertainty as to its correct admission into *Modiola*.

Modiola Deshayesiana? *J. Sowerby.* Tab. XIX, fig. 19.

A shell from Mr. Edwards's cabinet here represented is referred with doubt to the Bracklesham species. The figure 14 of Tab. XIII was copied from Mr. Dixon's work, and a comparison could not be instituted. I have therefore thought it desirable to represent the present specimen, as it presents a difference in outline, and may possibly belong to another species; at least it constitutes a variety, which I will call *Hempsteadiensis.*

The form of our fossil is more pointed in the siphonal region than the figure of the Bracklesham or the Paris Basin specimens; it is less regularly cylindrical, and not so elongated, and there is a considerable slope from the extremity of the hinge-line to the siphonilateral margin. Several casts of specimens have been found, and there is on one individual a portion of the shell remaining which is very smooth and glossy, and with a magnifier the fine and faint cross or radiating striæ may be seen. The animal appears to have formed for itself a thickened lining to the crypt in which it dwelt. The only locality at present known is Hempstead, where it is found embedded in the shell of an oyster.

In the 'Quarterly Journal of the Geol. Soc.' for November, 1862, p. 330, is a paper by Dr. Sandberger, in which he speaks of a fossil from Hempstead as identical with *Mod. delicatula*, Desh. This British fossil was received by him from Mr. Edwards, and is the same species as the one I have had figured, but I cannot coincide in Dr. Sandberger's opinion. The following differences appear to me to be sufficient to keep the English and the French shells specifically distinct. The umbo is more terminal, the ventral margin less convex, the dorsal or hinge area shorter, and the siphonal region is more oblique and pointed in our shell than in *M. delicatula.* My comparison is dependent upon the characters given by M. Deshayes; but judging from the figure and description by that accurate and able naturalist, I think the two forms cannot be specifically united.

23. Modiola (?) consobrina, *S. Wood.* Tab. XIX, fig. 17.

Length, 2 inches.

Locality. Alum Bay (*Fisher*).

One specimen is all that I have yet seen, and that unfortunately is not in a condition for fair determination. It was found, Mr. Fisher tells me, in the Bracklesham bed at Alum Bay; the specimen is firmly imbedded in the matrix (a sandy marl), by which the interior is hidden, and the umbonal region is not quite perfect. It differs from *M. subcancellata* principally in having fewer and coarser rays, and it has not the concentric ridges or distinct lines of growth subcancellating the exterior of that species. The figure has

been a little too much improved at the umbo, and it is difficult in its present condition to say whether it belongs to *Mytilus* or *Modiola*. Its present name is merely provisional.

16*. Modiola subcarinata? *Lamarck*. Tab. XIX, fig. 20.

At page 71, Tab. XII, fig. 9, is figured and described a shell from the London Clay at Highgate, and referred with doubt to Lamarck's species from the Paris Basin. Mr. Edwards has since obtained a specimen from Barton, with the general characters of the French species, although differing in some minor particulars, and I have thought it desirable that it should be represented. In comparing our present specimen with the figure of the Paris Basin species, there appears a difference in the length of the hinge-area, and also in the direction of the margins, both the dorsal and ventral margins being more curved in the French shell than in our own; there is also a slight difference between the Barton specimen and the one previously figured from Highgate, which has a more prominent or subcarinal projection, with the umbo rather more terminal.

Our shell is covered with elevated or rather imbricated lines of growth, and these are more distant upon the siphonal region than upon the other parts of the shell; they appear as if they once supported a fringed epidermis like that which ornaments the shell which has been called *M. barbata*.

Since the above was written and the figures engraved, I have seen a specimen in the cabinet of Mr. Prestwich of the following dimensions:—3¼ inches in length, with a height or breadth of 1 in., and a tumidity of an inch and half: this was obtained at Clarendon Hill, near Salisbury, and I presume it to be the same as *M. subcarinata* from Highgate.

24. Modiola subcancellata, *Edwards, MS.* Tab. XIX, fig. 15.

Locality. Barton (*Edwards*).

An imperfect specimen has recently come into the possession of Mr. Edwards, to which is attached the above specific name. It bears considerable resemblance to two species from the Paris Basin, viz., *Mod. Rigaultii*, Desh. ('An. sans vert. du Bass. de Paris, t. 1, p. 29, pl. 74, figs. 23, 24), and *Mod. Levesquei* (id., p. 30, pl. 75, figs. 4, 5); our shell appears to approach rather nearer to the latter, and, if the specimens themselves could be compared, might possibly be referred to that species; there are, however, some differences which may be here pointed out. The Barton shell does not appear to have been so broad or so high as that of the French species, neither has it so long an area for connexus; the dorsal edge is finely but deeply denticulated, as that of *M. Levesquei* is also represented to be, but it does not appear so much curved as in the latter. There

are two rather unequal and not very perfect teeth immediately beneath the umbo, within which is also the impression of the oral adductor; the external radiations are numerous and flat, and they bifurcate at an early age; the interspaces are ornamented with raised lines of growth, which impart to them an irregularly cancellated appearance, and these, if they exist, are not represented in the French shell. In the young state, the form resembles more the normal state of *Modiola*, which it seems to have nearly lost in the adult, where the umbo has become more pointed, like that of *Mytilus*.

ARCA. *Linnæus.*

Generic Character. Shell inequilateral, generally equivalved, more or less quadrate or trapezoidal; ventral margin sometimes closed, at others open or sinuated; externally covered with radiating striæ; umbones distant, with more or less open area for connexus; hinge straight, with many teeth; palleal impression entire.

This is almost exclusively a marine genus, and comprehends nearly five hundred species. Some of these, however, vary so materially in the form, number, and arrangement of the denticles upon the straight and elongated margin of the hinge, as to have been separated into several genera or sections, in accordance with those variations. The generality of species show an opening more or less in the ventral margin, indicating a habit in the genus to spin a byssus.

In some few species there is an inequality in the valves; when this is the case, the left one is the larger of the two, and this inequality is found principally in those species which are without a sinuated margin.

The hinge, or dental area, is quite straight; this in some species is furnished with numerous small teeth placed at right angles to the line of it; in others, the denticles are few in number and are variously inclined, until they become at the extremities parallel with the hinge-margin, exhibiting every possible degree of intermediate variation. The shells that have been generally included in this genus from the older rocks have most of them very oblique denticles, like those of *Cucullæa*, but they are not restricted to that form of dentition. The area between the umbo and the dental margin over which the connector is spread is at times very large and open; the diverging and chevron-formed lines which ornament this space are deeply impressed in the shell; into them a portion of the ligament has been inserted for strength and protection, as also to have an intervening raised portion on which to act as a fulcrum. There is in this character an approach to *Limopsis*, in which there is an angular depression; but it has not any analogy with the bipartite or amphidesmous form of connexus, inasmuch as the action of the whole connector is ligamental, acting by contraction and elongation. In *Pectunculus* the area is marked with a single divergence, forming an obtuse angle; but in the present genus, in which some of

the more inequilateral species have a large, open, and elongated space for connexus, the linear portion diverges from the umbo at an acute angle; and thus a greater strength is given to these lines than if they were spread over the entire surface. If the same mode of divergence existed in the siphonal region of these shells, the linear portions of the ligament would be extended at an angle so obtuse, that they would be almost useless for a ligature, and therefore another set of divergent lines is formed on this part of the dorsal area, by which a greater tenacity is obtained and the firmer union of the two valves is secured.

1. Arca appendiculata, *J. Sowerby*. Tab. XIV, fig. 3, *a*—*c*.

Arca appendiculata. *J. Sow.*, Min. Conch., t. 276, fig. 3, 1820.
— duplicata. *J. Sow.* Min. Conch., t. 474, fig. 1, 1824.
— — *Morris.* Catal. Brit. Foss., p. 185, 1854.
— lactea. *Solander*, in Brand. Foss. Hant., t. 8, fig. 106, 1766.
— sulcicosta. *Nyst.* Coq. foss. Belg. p. 257, pl. 18, fig. 9, *a*, *b*, 1843.

Spec. Char. A. testâ elongatâ, subtrapezoidali, gibbosulâ, inæquilaterali, æquivalvi, radiatim striatâ vel costulatâ, concentricè decussatâ; costulis duplicatis vel bifurcatis; siphoni-regione longiore, obliquè truncatâ; pedi-regione supernè angulatâ, infernè rotundatâ; umbonibus subprominentibus, incurvis; areâ connexûs magnâ, partim ornatâ.

Shell elongate, irregularly trapezoidal, tumid, inequilateral, equivalve, radiated with prominent lines or riblets, decussated by lines of growth; pedilateral margin angular above and rounded below; siphonal region angulated; beaks rather prominent, with a large area for the connector, partly lineated.

Length, 1½ inch; *height*, ¾ths of an inch.

Localities. Barton.

Belgium, Vliermael, Hoesselt, and Lethen (*Nyst.*).

This species is in England restricted to the above locality, where it is not very rare; and as I believe the four names above mentioned belong to one and the same species, I have adopted *appendiculata* as being the older of the four. The peculiar appearance which suggested the name appears to be a plain and naked space on the pedal side of the area for connexus, which is free from any diverging impressed lines, while they are distinct on the siphonal side; at least I presume this to be so; I am quite unable to see anything like appendages to this part of the shell. The exterior of the valve is ornamented with radiating striæ or riblets, and these generally duplicate, sometimes triplicate, on the outer or older portion of the shell; the lines of growth are prominent, decussating the interspaces as well as the rays, which, in consequence, become somewhat nodulous, particularly over the pedal region; the dental area is furnished with teeth along the entire length; they are at nearly right angles to the hinge-line, but incline as they recede from the centre.

2. Arca aviculina? *Deshayes.* Tab. XV, fig. 7, *a*, *b*.

Arca aviculina. *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 887, pl. 66, figs. 15—17, 1858.

Spec. Char. A. testâ elongatâ, angusto-subcylindraceâ, depressiusculâ, inæquilaterali, radiatim eleganterque costellatâ; costellis inæqualibus, in medio tenuibus; extremitatibus crescentibus, elevatis, subimbricatis; umbonibus depressis, brevibus; areâ connexûs parvâ; areâ dentali paucidentatâ.

Shell slender, elongate, subcylindrical, somewhat depressed, inequilateral, elegantly covered with rays or small ribs; rays smaller or thinner in the centre, enlarging towards the lateral margins; beaks small, depressed; area of the connector narrow; dental margin sparingly furnished.

Length, $1\frac{3}{8}$ inch; *height*, $\frac{9}{16}$ths.

Localities. Bracklesham, Bramshaw, Brook (*Edwards*), Huntingbridge (*Fisher*).

This is an elegant species, and, I believe, not very rare. There is considerable difference between our shell and the figure of the French species, to which it is here doubtfully referred; but I feel unwilling to separate them upon what do not appear to be essential distinctions. There is also a difference between the British specimens from different localities, those from Bramshaw and Brook being more delicately rayed than those from Huntingbridge and Bracklesham. In general, our shell appears to be less cylindrical than that of the Paris Basin species; but in this character our own specimens vary materially. The principal difference is in the position of the umbo, which is more eccentric in the British than in the French shell, and in this character the former more closely approaches *A. interrupta*, where the siphonal region is also broader or higher; but it differs from that species in being longer, differently rayed, and in having the central portion somewhat compressed, with an inflated or tumid siphonal region.[1]

3. Arca biangula, *Lamarck.* Tab. XIV, Fig. 1, *a—f.*

Arca biangula. *Lam.* An. du Mus., t. vi, p. 219, 1809, and t .ix, pl. 19, fig. 4, *a*, *b*, 1824.
— — *Desh.* Coq. Foss. des Env. de Par., t. i, p. 198, pl. 34, figs. 1—6, 1824.
— Branderi. *J. Sowerby.* Min. Conch., t. 276, figs. 1, 2, 1821.
— hyantula. *Desh.* Coq. Foss. des Env. de Par., t. i, p. 199, pl. 34, figs. 7, 8, 1824.
— — *Goldf.* Petr. Germ., vol. i, p. 143, t. 122, fig. 3, *a—d*, 1826.
Byssoarca Branderi. *J. Sow.*, in Dixon's Geol. Sussex, pp. 92, 169, t. 111, fig. 23, 1850.

[1] Since the above has been in press, I have seen the description and figure of *Arca Laekeniana*, Le Hon. ('Descr. succ. de quelq. nouv. esp. des terr. tert. Eoc. des env. de Brux.,' p. 7, No. 15), a species which more resembles our fossil than does the one to which it is here doubtfully assigned, but the rays upon our shell are somewhat different; they are apparently more distant, and have intermediate striæ, which are neither shown nor said to exist upon the Belgian fossil. I think, however, that when specimens of each can be compared, they may be found to be identical.

Spec. Char. A. testâ variabili, plerumquè oblongâ, angustatâ, subtetragonâ, subobliquâ, valdè inæquilaterali, striatâ; umbonibus distantibus, recurvis; siphoni-regione productâ, biangulatâ; striis radiantibus, numerosis, squamoso-granulatis.

Shell variable, for the most part elongately oblong; somewhat oblique, very inequilateral; umbones distant, recurved; siphonal region much the larger, biangulated; striæ numerous, granulated, and slightly imbricated.

Length, 3 inches; *height*, 1 inch.

Localities. Bracklesham, Selsey; var. β, Barton.

France, Grignon, Courtagnon, Senlis, Valmondois (*Desh.*).

The ligamental area in this species has a broad, flat, and deep depression, with chevron-formed lines, which when the valves are united form lozenge-shaped ornaments immediately beneath the umbo, one within the other, the smaller closely approaching the hinge-margin; sometimes there is another set of the lozenge-shaped marks on the siphonal region, but these latter are more often only parallels to the radiating umbonal lines. In specimens from Barton this area is tinged with a dark-red colour by the remains of the ligamental connector. The hinge-margin is furnished with numerous small teeth, rather more strongly displayed in the young state than in the old. Most of the large specimens from Bracklesham have the outside much eroded and nearly smooth, like specimens of *A. tetragona* that have inhabited some crypt where the movements of the animal have abraded the otherwise striated surface of the shell. This species is particularly abundant at Bracklesham, where it attains to large proportions. In the full-grown shell from that locality there is generally a large sinus, the ventral margin being deeply indented; but in the younger shells from the same locality this is not so strongly marked, and in some of those from Barton the valves are quite closed; it is so, however, with various specimens of *A. tetragona*. The shell called *A. biangula*, from the Bordeaux and Touraine beds, is by M. Deshayes considered as not identical with the Paris Basin species, and in this I think he is correct. There is, however, a slight difference between our own shell and that of the Paris Basin, ours being more finely striated all over, especially so upon the pedal region. Mr. Sowerby has retained the name of *A. Branderi* for the British fossil, which, he says (p. 169), "differs from *A. biangula*, Desh., in having a much less acute keel." The keel, however, is variable in that respect among the French fossils, and this difference does not always exist in the British shell. The pedal region in specimens from Barton is sometimes broader or higher than in those from Bracklesham; this arises from a less sinuated margin, which otherwise contracts the shell at that part; the large rays have generally a smaller intermediate one, and these are decussated by very visible lines of growth. The Barton shell may, perhaps, be considered as a variety under the name *Branderi*, but I think there is not a specific difference; it much resembles *A. miniata*, Desh.

4. Arca depressa, *J. Sowerby*. Tab. XIV, fig 4, *a—c*.

Arca depressa. *J. Sow.* Min. Conch., t. 474, fig. 2, 1824.
— — *Morris.* Catal. Brit. Foss., p. 185, 1854.

Spec. Char. A. testâ tenui, elongato-oblongâ, valdè inæquilaterali, depressâ, radiatim striatâ et concentricè decussatâ; striis tenuibus, distantibus, subtuberculatis; marginibus ventrali et dorsali subparallelis.

Shell thin, elongately oblong, very inequilateral, depressed, radiately striated, and concentrically decussated; striæ thin, and slightly tuberculated; ventral and dorsal margins nearly parallel.

Length, $\frac{7}{8}$ths of an inch; *height*, $\frac{1}{2}$ an inch.

Localities. Woolwich (*Sowerby*), Basingstoke (*Prestwich*).

The specimens of this species that I have seen are very few and imperfect, and the characters for specific determination are not satisfactorily displayed. The principal distinction appears to be its depressed form, or shallow valve; the striæ upon the exterior Mr. Sowerby describes as "very distant upon the anterior side (siphonal region ?), and appear like small knotted threads;" those on the shorter or pedal region are close, with interspaces of the same width. The cast of a species of Arca in Mr. Prestwich's cabinet from New Cross, Tab. XV, fig. 15, has the above name (in MS.) attached, and I have had it figured, as it appears somewhat to differ in being more inequilateral; but it is scarcely possible to determine a species from a cast alone.

5. Arca Dulwichiensis, *Edwards*, MS. Pl. XV, fig. 6, *a*, *b*.

Spec. Char. A. testâ ovato-oblongâ, subobliquâ, gibbosulâ, valdè inæquilaterali, utráque extremitate latè obtusâ, in medio depresso-sinuosâ, radiatim costellatâ; costulis angustis prominulis, in siphoni-regione distantioribus; cardine—?

Shell ovately oblong, slightly oblique, somewhat gibbous, greatly inequilateral; each extremity broadly obtuse; ventral margin slightly sinuated, covered with radiating riblets, rather distant upon the siphonal region; hinge—?

Length, $1\frac{7}{8}$ inch; *height*, $\frac{7}{8}$ths of an inch.

Locality. Dulwich (*Edwards*).

A few specimens of a shell, apparently belonging to this genus, have been turned out of the "diggings" for the main sewer at Dulwich; they enrich the cabinet of Mr. Edwards. These specimens, unfortunately, do not exhibit to view the hinge-area; but the exterior has the form and sculpture which generally characterise the genus *Arca*. The valves have been pushed a little out of their natural position, and display a few elongated furrows and ridges nearly parallel with the dorsal or outer margin of the shell; these

resemble the parallel lines upon *A. heterodonta*, Desh. ('An. sans vert. du Bass. de Par.,' p. 906, pl. 67, figs. 22—25), but the lines upon our shell appear to be in the area for connexus, and not upon the dental margin; this I am unable correctly to ascertain. Our shell is very inequilateral, and the siphonal region is not only longer, but larger and higher; the radiations are a little wider or further apart on the larger or broader portion of the shell than upon the pedal region. This shell resembles, in outline, *A. obliquaria*, Desh. (id., p. 893, pl. 67, figs. 8—10, 10 bis), but is larger, shorter, and not quite so oblique. It is separated from *A. depressa*, as well by difference in outline as by the apparent difference in the hinge-area.

6. Arca eximia, *Edwards*, MS. Tab. XV, fig. 3.

Spec. Char. A. testâ elongatâ, obliquè sub-quadrangulari, valdè inæquilaterali, sub-depressâ, radiatim costulatâ et concentricè decussatâ, punctatâ; umbonibus prominentibus, distantibus; areâ connexûs lævigatâ; dentibus medianis minimis: siphoni-regione productâ.

Shell elongate, oblique, irregularly quandrangular, very inequilateral, somewhat depressed, punctated, covered with radiating lines or riblets, crossed by distinct lines of growth; beaks rather prominent; area of the connector rather narrow and smooth; teeth small in the middle of the dental area; siphonal region produced.

Length, ¾ths of an inch.

Locality, Brook (*Edwards*).

A single specimen of the left valve of a species which appears to be quite distinct, and to which is attached the above MS. name, is in the cabinet of Mr. Edwards; it is not quite perfect, and so closely attached to the matrix that I am unable to see the interior. Its nearest relative is, I think, *A. punctifera*, Desh. (p. 202, pl. 32, figs. 13, 14), but it differs from that species in several characters. The English shell appears to be more elongated and more inequilateral, and to have the area for connexus larger and broader than that described in the French shell, in which it is characterized as being so small and narrow as to bring the umbones almost close together, giving thereby a very small extent for the marginal separation of the valves. Our shell has the surface regularly rayed, with rather narrow and rounded single lines, which are decussated by broad and prominent lines of growth, leaving between each a deep depression or puncture; and where the rays are narrowest these punctures are, of course, most numerous. The area for connexus is broad, flat, concave, and smooth, and widest over the pedal region; the denticles are close and numerous, inclining towards the extremity of the hinge-line. I am unable to see if the internal edges of the margin be denticulated. *A. exornata*, Desh. ('An. sans vert. du Bass. de Par.,' p. 889, pl. 69, figs. 1—3), as also *A. intersecta*, figs. 25—27, resemble it in some characters.

7. Arca globulosa (?), *Deshayes*. Tab. XV, fig. 9, *a*, *b*.

Arca globulosa. *Desh.* Coq. Foss. des Env. de Par., t. i, p. 209, pl. 33, figs. 4—6, 1824.

Spec. Char. "*A. testâ ovato-oblongâ, brevi, gibbosâ, globulosâ, subcordatâ, inæquilaterali, obliquatâ, striatâ, striis alternis minoribus, lævigatis; cardine arcuato, multidentato* (?); *margine crenato.*"—Deshayes.

Shell ovately oblong, short, tumid, or somewhat globular or gibbous, inequilateral, oblique, and striated; striæ alternately large and small; dental margin slightly curved; ventral margin deeply crenulated.

Length, $\frac{1}{8}$th of an inch; *height*, $\frac{1}{12}$th of an inch.

Locality. Highcliff, Barton.

This is not particularly rare. I have referred it, with considerable doubt, to the Paris Basin shell. It may possibly be a variety, *subglobulosa*.

On comparison with French specimens, I find that the English shell is rather smaller, less quadrate, or more rounded on the siphoni-lateral margin; and the dental area in the French shell is longer, and furnished with more numerous teeth, 17, 18 (*Desh.*); our specimens have four denticles on one side of the umbo and five on the other; those on the siphonal side are much inclined, almost parallel with the margin at the extremity, and, from the comparatively great depth of the valve, I imagine that our shell is a full-grown species, and not the fry of a larger one. The sculpture on the exterior resembles that upon *A. scapulina*, the rays being alternately one large and one small; the smaller rays are nodulous, and the interspaces are decussated, the lines of growth being large, prominent and regular, thickening periodically the smaller rays; but the larger rays are nearly smooth. There appears to be in this species a small triangular fossette beneath the umbo, like that in *A. lævigata*, dividing the connector into two different arrangements, as in *Limopsis*.

8. Arca impolita, *J. Sowerby*. Tab. XV, fig. 4, *a*, *b*.

Arca impolita. *J. Sow.* Geol. Trans., 2nd ser., vol. v, p. 136, pl. 8, fig. 10, 1834.
— — *Morris.* Catal. Brit. Foss., p. 185, 1854.

Spec. Char. A. testâ oblongâ, convexâ, tumidâ, lævigatâ, glabrâ; valdè inæquilaterali, pedi-regione brevi, rotundatâ; siphoni-regione sub-quadratâ; marginibus intùs integris; dorsali et ventrali sub-parallelis.

"Transversely oblong, very convex; marked with longitudinal rows of punctures; anterior portion small, rounded; posterior rounded; front parallel to the hinge-line; shell thin."—*J. Sowerby.*

Length, $\frac{3}{8}$ths inch; *height*, $\frac{3}{8}$ths inch.

Localities. Hampstead, Potter's Bar, Highgate, Haverstock Hill (*Edwards* and *Wetherell*).

"It approaches *A. cucullaris*, Desh. (vol. i, p. 206, pl. 33, figs. 1, 2, 3), but differs slightly in form as well as in the teeth being all transverse."—*J. Sowerby.*

All the specimens of this species that I have been able to see have the two valves united, and the dentition obscured; it resembles *A. niteus* of the same deposit, but is less oblique.

A small individual in Mr. Wetherell's cabinet (fig. 4, *c*) appears to be free from all exterior ornament; it is possible that this may be the result of abrasion. There are also a few specimens of this genus in the same cabinet from the well at Hampstead, which are in a mutilated condition, and not sufficiently perfect for determination; they resemble the present species in shape, but appear to be more strongly and distinctly radiated.

9. Arca interrupta, *Lamarck.* Tab. XV, fig. 2, *a*, *b*.

Arca interrupta.	*Lamk.* (non *Poli*).	Ann. du Mus., t. 6, p. 220, No. 5, 1809.
—	—	*Desh.* Coq. Foss. des Env. de Par., t. i, p. 213, pl. 32, figs. 19, 20, 1824.
—	—	*Id.* An. sans Vert. du Bass. de Par., t. i, p. 888, 1858.
—	—	*Morris.* Catal. Brit. Foss., p. 185, 1854.
Byssoarca interrupta.		*J. Sow.*, in Dixon's Geol. of Suss., p. 93, t. 111, fig. 21, 1850.

Spec. Char. A. testâ obliquâ, ovato-oblongâ, compressâ, valdè inæquilaterali; costulatâ et decussatâ; pedi-regione angustiore, siphoni-regione latiore et longiore; cardine brevi, in medio edentulo, ad utramque extremitatem recurvo, pauci-dentato.

Shell oblique, ovately oblong, compressed, very inequilateral; striated and decussated by lines of growth; pedal region narrow and short; hinge area edentulous in the centre; extremities with few oblique denticles; ligamental area narrow; umbones approximate.

Length, 1 inch; *height*, $\frac{1}{2}$ inch.

Localities. Bracklesham, Selsey (*Edwards*).

France, Grignon, Parnes, Mouchy, Fontenay, Auvers (*Deshayes*).

A fine series of this shell enriches the cabinet of Mr. Edwards. It is slightly compressed in the centre and contracted in the ventral margin opposite the umbo, but it has very little gape. The hinge-area contains about six or seven denticles, those on the pedal side (three or four) are very slightly inclined to the hinge-margin, neither are the three or four on the siphonal side quite parallel with the dorsal edge. Between the striæ or costæ, which strongly denticulate the margins, there is an intermediate ray. Some of the French specimens are a trifle broader in the siphonal region than in the English shells, and the intermediate ray is scarcely so prominent.

10. Arca lævigata, *Caillat.* Tab. XV, fig. 8, *a, b.*

Arca lævigata. *Caillat.* Desc. des quelq. Coq. Nouv., p. 4, pl. 2, fig. 7, 1834.
— — *Nyst.* Tabl. Syn. des Arches, p. 40, No. 212, 1849.
— — *D'Orb.* Prod. de Paléont., t. ii, p. 390, No. 1059, 1850.
— — *Pictet.* Traité de Paléont., t. iii, p. 551, 1855.
— — *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 905, pl. 68, figs. 23—26, 1858.
— elegans. *S. Wood.* Lond. Geol. Journ., p. 3, 1846.
— prætenuis. *Charlesworth.* MS. Nat. Hist. Soc. Illust.

Spec. Char. A. testâ minutâ, glabrâ, tumidâ, ovato-subquadrangulari vel subtrapeziformi, subæquilaterali; pedi-regione latè semicirculari; siphoni-regione paulo minore, angulatâ vel obliquè truncatâ; umbonibus acutis, distantibus; margine integro, dentibus in medio interruptis; fossulâ in areâ cardinali excavatâ.

Shell small, glossy, ovately quadrate or slightly trapeziform; subequilateral, subequivalve, tumid; pedilateral margin rounded; siphonilateral truncated or angulated; beaks distant; margins smooth; triangular depression in cardinal area.

Length, $\frac{1}{10}$th inch; *height*, $\frac{1}{15}$th of an inch.

Localities. Barton, Bracklesham (*Edwards*), Isle of Wight (*Charlesworth*).
France. Grignon, &c., Calcaire grossier (*Desh.*).

This elegant little shell is by no means rare in England, and specimens present considerable variation.

I have obtained it also from a small patch of the so-called Upper Marine, which intervenes between the true freshwater deposits at Hordle.

There is a peculiarity about this and one or two other species hitherto included in the genus *Arca* which will entitle them to be placed in a distinct section, perhaps to be regarded as forming a distinct genus; they present the same difference from *Arca* that *Limopsis* does from *Pectunculus*, having a portion of connexus placed in a triangular pit immediately beneath the umbo.

M. Deshayes has figured and described two species with this peculiarity in the connector, viz., *A. lævigata* and *A. effossa*, the latter differing from the former in having the exterior surface more distinctly cancellated, while the former is described as being quite smooth, as the name imports. Our little shell corresponds in outline, and pretty well so in magnitude and relative proportions, with both these species, but it does not correctly agree with either in the ornamentation, except that there are a few more prominent rays over the angular ridge on the siphonal region; it has the exterior cancellated, though in a fainter or minor degree than *A. effossa*, but it is not smooth in perfect specimens. This, M. Deshayes remarks, is the smallest known species of the genus, and it is not quite equivalved, the right valve being slightly the larger of the two. It approaches closely to *Trigonocœlia*, and might be called *Trigonodesma*.

Since my Plate was engraved, I have seen in Mr. Prestwich's cabinet a small *Arca* found by himself at Shapley Heath, and mentioned in the 'Journ. of the Geol. Soc.,' 1847, p. 390, as an undescribed species. This shell strongly resembles the above, and as Mr. Prestwich considers the deposit in which it is found as belonging to the Bracklesham series, it must, for the present at least, have the same name: it does not, however, satisfactorily conform to the characters of the Barton shell, neither to the specimens found at Bracklesham; in those shells the pedal region is decidedly the larger of the two, and is longer and more elevated; the whole shell is also shorter and more tumid. The Shapley Heath specimens are comparatively longer, and the pedal side is the shorter; the hinge-area also appears to have fewer and larger denticles, and the exterior, so far as can be observed, is quite smooth. I feel unwilling to make another species of it from want of better materials, but I think it must at least be considered as a variety.

11. Arca Lyelli? *Deshayes.* Tab. XV, figs. 12, *a*, *b*, and 13, *a*, *b*.

Arca Lyelli. *Desh.* Coq. Foss. des Env. de Par., t. i, p. 200, pl. 34, figs. 9—11, 1824.
— — *Id.* An. sans Vert. du Bass. de Par., t. i, p. 873, 1859.

Spec. Char. A. testâ elongatâ, subcylindraceâ, gibbosulâ, inæquilaterali, plus minusve irregulari, sulcatâ aut radiatim costulatâ et concentricè squamoso-lamellosa vel tuberculosâ; siphoni-regione longiore angulatâ aut obliquè truncatâ; umbonibus minimis, depressis, obliquis; areâ connexûs angustâ, dentibus medianis irregularibus; marginibus crenulatis.

Shell transversely elongate, subcylindrical, slightly tumid, inequilateral, more or less irregular in outline, covered with radiating and rounded ridges decussated by lamellated lines of growth; siphonal region the longer, and obliquely truncated; umbones depressed: area for connector small, narrow; margins crenulated.

Length, $\frac{5}{8}$ths of an inch.

Localities. Barton (*Edwards*), Colwell (*H. H. Wood*).

This species seems to be rare in our Eocene beds. A few specimens from Barton are in Mr. Edwards's cabinet, and the Rev. H. H. Wood has kindly sent me a specimen from Colwell Bay.

The shell from the French beds, to which this is with some slight doubt referred, is said to be variable; and M. Deshayes has proposed two new species, *A. contorta* and *A. lamellosa*, which he thinks, however, may be ultimately united to *A. Lyelli*, and I am inclined to the same opinion. The shell represented by fig. 13 of our Plate, which I at first imagined to be distinct, may perhaps be referred to *lamellosa*, and that by fig. 12 to *contorta;* these all so closely accord with *A. clathrata*, that I am doubtful whether the Touraine shell be anything more than a variety induced by difference of conditions. Among the few English specimens that I have seen, there is considerable variation; in one the dental area has only a few large teeth, in another of the same size this margin is studded

with double the quantity of denticles; in some the margin is crenulated all round, in others the central portion appears to be free from crenulations, and in *A. contorta* the margin is said to be smooth; this variation is perhaps dependent upon the state of preservation of the specimens. The surface of our shell is covered with rounded rays more or less broad or numerous, and these rays generally project at the margin, particularly on the siphonilateral region; this is more especially the case in the shell fig. 12, where the diagonal or carinal ridge is prominent, and the rays are more distinctly lamellated. The position of the umbo is not a permanent character, some specimens being more inequilateral than others.

12. Arca modioliformis, *Deshayes*. Tab. XIV, fig. 5, *a*, *b*.

Arca modioliformis. *Desh.* Coq. Foss. des Env. de Par., t. i, p. 214, pl. 32, figs. 5, 6, 1824.
— — *Id.* An. sans Vert. du Bass. de Par., t. i, p. 896, 1858.
— — *Potiez* et *Mich.* Gal. de Douai, t. ii, p. 111, No. 16, 1844.

Spec. Char. A. testâ elongato-obliquâ, ovatâ vel irregulariter trapeziformi, valdè inæquilaterali, modioliformi; radiatim striatâ, striis in siphoni-regione depressis, undulatis distantioribus; cardine in medio edentulo.

Shell elongately oblique, ovate or irregularly trapezoidal, very inequilateral, radiately striated, the striæ on the siphonal region somewhat undulating and distant; hinge-line without denticles in the centre, with a few only at each extremity.

Length, 1 inch; *height*, $\frac{7}{10}$ths of an inch.

Localities. Stubbington (*Edwards*).

France, Cuise-Lamothe, Valmondois (*Deshayes*).

This is apparently a tolerably well-marked species. I have seen only three British specimens; these correspond so well with the Continental shell, that I think there will be no dissent from the identification.

M. Deshayes gives two varieties of his species in his first work, but in his more recent one he has separated what were formerly included under the above name. Our shell appears better to agree in form and in the exterior ornament with what he has called *A. Rigaultiana;* but the ligamental area is narrower, neither has the British fossil so many denticles. Old shells will often have the area of connexus enlarged, but the central portion of the dental area in that case has the denticles obliterated, somewhat after the manner of those in *Pectunculus*.

13. Arca nitens, *J. Sowerby*. Tab. XV, fig. 5 *a*, *b*.

Arca nitens. *J. Sow.* Trans. Geol. Soc., 2nd ser., vol. v, p. 136, pl. 8, fig. 9, 1834.
— — *Prestwich.* Geol. Journ., 1847, p. 401.

Spec. Char. A. testâ elongatâ, obliquâ, subtrapezoidali, convexâ, tumidâ, lævigatâ

glabrâ, valdè inæquilaterali; pedi-regione brevi, rotundatâ, siphoni-regione altiori, subcuneiformi vel obtusè angulatâ; umbonibus prominulis; marginibus integris.

Transversely oblong, convex, smooth, and glossy; pedal region the shorter; siphonal region obtusely wedge-shaped; front oblique; shell thin; beaks slightly prominent; inner margin of valves smooth.

Length, $\frac{1}{2}$ inch; *height*, $\frac{3}{16}$ths of an inch.

Localities. Hampstead (*Wetherell*), Primrose Hill (*Edwards*).

"Some specimens have a few punctures, in which character they approach *A. impolita*."—*Sow.*

This species is not quite so abundant as *A. impolita*, which it much resembles. The difference which appears to have caused the separation is a little more obliquity in the siphonal region of this species. The ventral margins appear to be free from crenulations, or at least, if they possessed them, they were very small and fine, and there is no sinuation for a byssus. The punctures spoken of by Mr. Sowerby arise from the want of continuity in the smoothness of the outer coating by which the radiating lines are seen distinctly separated, showing punctures or depressions between them and the decussating lines of growth.

14. Arca planicosta, *Deshayes.* Tab. XIV, fig. 2, *a*, *b*.

Arca planicosta.	*Desh.*	Coq. Foss. des Env. de Par., t. i, p. 204, pl. 32, figs. 1, 2, 1824.
—	—	*D'Orbigny.* Prod. de Paléont., t. 2, p. 390, No. 1047, 1850.
—	—	*Desh.* An. sans Vert. du Bass. de Par., t. i, p. 878, 1858.
Byssoarca duplicata.	*J. Sow.*, in Dixon's Geol. of Suss., p. 93, pl. 3, fig. 22, 1850.	

Spec. Char. A. testâ elongatâ, subcylindraceâ, convexiusculâ, inæquilaterali, tenui, in medio depressiusculâ; siphoni-regione valdè longiore, obtusè angulatâ; pedi-regione convexâ, marginibus ventrali et dorsali subparallelis; radiatim costellatâ costellis sæpius planulatis, bifurcatis, aliquando granulatis; umbonibus depressis areâ ligamenti angustâ; dentibus in medio minimis, utráque extremitate obliquis.

Shell elongate, subcylindrical, inequilateral, siphonal region much the longer, central portion depressed; pedilateral margin convex, siphonilateral margin obtusely angulated, dorsal and ventral margins nearly parallel; radiately costated with flattened and sometimes divided rays; umbones depressed, ligamental area narrow; teeth small in the centre, inclining towards each extremity.

Length, 2 inches; *height*, 1 inch.

Localities. Bracklesham, Bramshaw, Brockenhurst, Brook (*Edwards*).

France, Senlis, Parnes, Valmondois, Auvers, Le Fayel (*Deshayes*).

This is by no means rare at any of the localities cited, but I have not seen it from Barton. It appears to correspond with the Paris Basin shell of the above name, and it

is closely allied to *A. barbatula;* it differs from the Barton *A. appendiculata* in being more elongated and less inflated, and the siphonilateral margin is more rounded, less angular, and not so much produced. The rays also are more prominent in *appendiculata*, and the lines of growth more distinct, giving to that shell a more elaborate ornamentation; it has also a larger or broader ligamental area; the extremity of the hinge-line on the pedal side is more angular, and there is a difference in the dentition. This species also appears to attain to larger proportions. The only variation that I can detect between the English shells and the French species, to which they are referred, is that the rays upon the siphonal region of the Engish shells are not quite so broad as upon those from the Paris Basin. The margin of the interior of our shell is slightly and irregularly denticulated. Considerable variation exists among specimens in regard to proportional dimensions, more particularly in those from Huntingbridge; in some the height is equal to three fifths of the entire length, but in others the shell is very cylindrical, with a height not equalling half the length.

In the list of fossils from the Eocene deposits of this country, given by Mr. Prestwich in his paper on the London Clay, published in the 'Journal of the Geol. Soc.,' vol. iii, p. 401, is the name of *A. barbatula*, as from Barton and Bracklesham. I have not seen a specimen from any of our British deposits that can be safely referred to that species; the nearest approach to it are some of the elongated specimens of this species from Huntingbridge.

15. Arca tegulata, *Edwards*, MS. Tab. XV, fig. 10, *a*, *b*.

Spec. Char. A. testâ elongatâ, subcylindraceâ, depressâ, lucidâ, tenui, inæquilaterali; obsoletè costatâ concentricè decussatâ; pedi-regione sub-attenuatâ, siphoni-regione paulo dilatatâ, umbonibus minimis, remotis, prominulis; areâ connexûs angustâ, lanceolatâ, lævigatâ; dentibus —?

Shell elongate, somewhat cylindrical, depressed, glossy, thin, and inequilateral; obsoletely or lightly rayed, and decussated by lines of growth; siphonal region a little the broader; umbones small, remote and prominent; area for ligament narrow and smooth.

Length, $\frac{3}{4}$ths inch; *height*, $\frac{1}{4}$th inch.

Locality. Bracklesham (*Edwards*).

This appears to be intermediate in form between *A. angusta*, Desh. ('Coq. foss. des Env. de Par.,' t. 1, p. 201, pl. 32, figs. 15, 16), and *A. lucida*, Desh. ('An. s. vert. du Bass. de Par.,' t. 1, p. 891, pl. 67, figs. 26—28), it is nearer to the latter, but it is not so broad in the siphonal region. Ours is an elegantly formed shell, and the only specimen I have seen which has the two valves united is the one figured. The surface is ornamented with rays irregularly distant; those on the pedal region are narrow and close, increasing in size as they approach the siphonal region, where they are broad and flat with a narrow line between them; these are crossed by a broad flat ridge of growth, which is smooth,

and it imparts a gloss or polish to the exterior like that of *A. lucida*. The dental area of our shell appears to be well furnished with teeth, and there is a slight sinuation in the ventral margin.

16. Arca tessellata, *Fisher*, MS. Tab. XV, fig. 14, *a*, *b*.

Spec. Char. A. testâ crassâ, elongatâ, ovato-oblongâ, depressâ, sub-obliquâ, inæquilaterali; siphoni-regione angulo decurrente definitâ; sulcis quatuor crassis, granosis ornatâ; umbonibus depressis, obliquis; areâ connexûs obliquâ, sulcatâ, areâ cardinali arcuatâ in medio edentulâ, ad extremitatem pauci-dentatâ; margine ventrali sinuoso, integro.

Shell elongate, of an ovately oblong form, depressed, slightly oblique, inequilateral; siphonal region with an angular elevation, ornamented with four thick rays; beaks depressed, oblique; area of connector narrow, oblique, and ridged angularly; dental area slightly curved, with few teeth at the extremities, central portion plain; ventral margin sinuated, edges plain.

Length, $1\frac{3}{4}$ inch; *height*, $\frac{7}{8}$ths of an inch.

Localities. Brook (*Fisher*), Huntingbridge (*Edwards*).

This appears to be closely related to two or three species found in the Paris Basin, but with no one of which does it accord so as to be satisfactorily regarded as an identity. It is not far removed from *A. rudis*, Desh. ('Coq. foss. des Env. de Par.,' t. 1, p. 210, pl. 33, figs. 7, 8), but the rays and decussating ridges of that species are larger and coarser than they are on our shell, and the dental area is different. *A. Morieri*, Desh. ('An. vert. du Bass. de Par.,' p. 874, pl. 65, figs. 18, 19), also resembles our shell, but it has a less prominent and less distinctly marked angular ridge, running from the umbo diagonally across the siphonal region. The rays which ornament our shell are broad and flat, separated by a deep and narrow depressed line, decussated by distinct lines of growth, which imbricate the rays on the larger side. The adductor-muscle-marks are large, particularly the oral one, and the mantle-mark is not very near to the margin of the shell; there is also a long pedal-muscle-mark under the dental margin on the siphonal side. The teeth of our specimens are not in very good condition, but they appear to have been numerous, and those on the pedal side are slightly inclined. There is a sinus or indenture in the margin for a byssus, and the siphonal region is broader or higher than on the pedal side.

A fossil apparently identical with this species has recently been obtained at Lattorf, Magdeburgh, by Herr A. von Koenen, in a deposit of the Upper Eocene (or in what is called by the German geologists Oligocene) period. The German specimens are, however, much larger than our own. One perfect individual measures three and a half inches, and a fragment of the same species indicates a length of nearly five inches.

17. Arca tumescens, *Edwards*, MS. Tab. XV, fig. 1, *a*, *b*.

Spec. Char. A. testâ mediocri, subquadrangulari, sub-inæquilaterali, æquivalvi, gibbosâ vel tumidâ; radiatim tenuissimè striatâ et concentricè decussatâ, politâ; siphoni-regione longiore, vix latiore; marginibus dorsali et ventrali subparallelis, umbonibus approximatis, depressis; areâ cardinali angustâ.

Shell of moderate size, subquadrangular, slightly inequilateral, equivalve, gibbous or tumid, finely radiated, and decussated by slender concentric lines of growth, glossy; dorsal and ventral margins nearly parallel; beaks small or depressed, with a narrow ligamental area.

Length, $\frac{5}{8}$ths; *height*, $\frac{3}{8}$ths of an inch.

Localities. Clarendon, Brook (*Edwards*).

Mr. Edwards's cabinet contains several specimens of this species, in good preservation, and they appear to deserve a distinct specific name. The shell, in some characters, resembles *A. impolita*, but it is more tumid, more equilateral than that species, and it is also more quadrangular, and it is polished and glossy; the very fine striæ with which it is covered are scarcely visible to the unassisted eye; the lateral margins are roundedly angular, and the siphoni-lateral region is rather the broader or higher of the two. It is a handsome shell, resembling, in some slight degree, our common recent species *A. lactea*.

18. Arca Websteri, *Forbes*. Tab. XV, fig. 11, *a*, *b*.

Arca Websteri. *Forbes*. Mem. Geol. Surv., 1856, p. 150, pl. 3, fig. 8.

Spec. Char. "*T. parvâ, ovato-oblongâ, modioliformi, transversim sulcatâ, radiatim striatâ, antice angustiori, postice latiori, effusâ, sub-carinatâ; striis posticis elevatis, acutis, striis cæteris obscuris; carinâ rotundatâ; cardine interrupto, dentibus prominentibus, distantibus.*"

"A small, depressed, modioliform shell, transversely sulcated and with radiating striæ; the anterior narrow, the posterior part spread out and somewhat carinate; the posterior striæ are elevated and acute."

"The umbones are placed near the anterior margin, and the middle part of the cardinal area is without teeth. The teeth are prominent and distant."—*Morris*.

Length, $\frac{5}{8}$ths of an inch; *height*, half the length.

Locality. "From the Bembridge series." (*Morris*.)

This is a pretty little species, and appears to be confined to the Upper Eocene Deposits. Its principal distinctions are the form of the siphonal region and the ornament with which it is covered. The shell is rather tumid, and a very obtusely angular ridge or

rounded projection extends from the umbo to the base of the siphonilateral margin; the radiating striæ are close and regular upon the pedal and ventral regions, but upon the dorsal slope of the siphonal region these rays are more than usually distant, and are somewhat nodulous; it is very inequilateral, with a recurved and rather prominent umbo.

CUCULLÆA.[1] *Lamarck*, 1801.

Generic Character. Shell equivalve, inequilateral, trapeziform or subquadrate, ventricose; valves closed and striated; umbones remote, separated by a wide and concave ligamental area; anal muscular impression bounded by an elevated ridge; hinge linear, furnished with a few teeth, generally lateral and oblique, but parallel with the hinge-line at the extremities; connexus ligamental.

The shells of this genus approach so closely to some of the *Arcæ*, that it is doubtful, in the opinion of several naturalists, if there be any good character by which the two can be generically separated. The principal distinction is its subquadrate outline and inflated form, for many of the Ark shells of the older rocks have their dental apparatus with a very similar arrangement, the lateral teeth being few and oblique, sometimes parallel with the hinge-line. Mr. Lycett proposed a genus under the name *Macrodon* for certain fossils of the Oolitic Formation, in consequence of the hinge-denticles differing somewhat in their number and position; those on the pedal side of the margin being almost at right angles to the hinge-line, while at the opposite extremity they are parallel with it, appearing thus to combine or unite the two genera, *Arca* and *Cucullæa*. The British species, *Arca raridentata*, has the teeth much inclined on both sides. Very many fossils have been placed in this genus, beginning as low as the Silurian Rocks and ranging up to the present period; only one living species is known which truly resembles the typical form, and that is an Oriental shell. Some of the fossil species have the umbones inflected in a subspiral manner, but a commencement of this form may be seen in some of the *Arcæ*.

CUCULLÆA DECUSSATA, *Parkinson*. Tab. XVII, fig. 8, *a—c*.

CUCULLÆA DECUSSATA.	*Park.* Org. Rem., vol. iii, p. 171, t. xiii, fig. 1, 1811.
— —	*J. Sow.* Min. Conch., t. 206, figs. 3, 4, 1818.
— CRASSATINA.	*Morris.* Catal. Brit. Foss., p. 197, 1854.
— —	*Prestwich.* Quart. Journ. Geol. Soc., 1854, p. 109.

Spec. Char. Testâ transversâ, ovato-oblongâ, gibbosâ, incrassatâ, obliquâ, inæquilaterali, decussatim striatâ, in medio compressiusculâ; pedi-regione brevi, obtusâ, siphoni-regione

[1] Ety. Cucullus, *a hood.* Type, *Arca cucullus*, Linn.

subangulatâ; areâ connexûs angustâ; sulcis raris exaratâ; marginibus denticulatis; dentibus lateralibus tribus.

Shell transverse, ovately oblong, inflated, thick, oblique, and inequilateral, striated and decussated, slightly compressed in the middle of the shell; pedal region short; ligamental area rather narrow, with few and obsolete chevron-form marks; margins denticulated, three lateral teeth on each side.

Length, 2½ inches; *breadth*, 1½ inch.

Localities. Faversham (*Crowe*), Herne Bay, Richborough, Oakwell, near Faversham, Nash Park, near Boughton (*Prestwich*).

This shell is considered by Professor Morris, in his 'Catalogue of British Fossils,' as identical with *Cucullæa crassatina*, Lamk.; but, although there is a very close approximation, I am doubtful of their identity; and, as I am not imposing a new name, I prefer the British fossil should remain with the one under which it was figured and described by Parkinson and Sowerby.

On a comparison of the English shells with specimens in my own cabinet from Beauvais, I find the following differences:—The French shells appear to be more inflated, and they have a more prominent, angular, and distinct ridge diagonally across the syphonal region, and the English shells are comparatively longer; neither can I see the great inequality between the two valves which is so conspicuously shown in the French specimens; the rays upon our shell are large, wide, flat, and bipartite, and these rays are more nearly alike upon the two valves than are those of *C. crassatina*. The dental area is furnished with a few teeth at each extremity of the line; those on the siphonal side are about three or four in number, and parallel with the hinge-margin; at the opposite extremity there are about the same number, and they are also inclined; all of them are vertically striated, or rather denticulated, but more finely so than are either of the French species, and in the centre of the hinge-line are a few small teeth in a vertical direction; these are also finely nodulous; the margin is crenulated by the outcrop of the rays.

PECTUNCULUS, *Lamarck*, 1789.

Gen. Char. Shell equivalve, orbicular, convex, or lenticular, nearly equilateral, smooth, or radiately striated; umbones central, generally distant, divided by a striated area for connexus, which is wholly external or ligamental; hinge with a curved row of transverse or angular denticles; adductors nearly equal, palleal line simple, margins crenulated; the shells in the living state are generally covered by a thick and velvety epidermis.

Animal with the margins of the mantle simple, sometimes studded with minute ocelli; foot large, crescent-shaped, capable of considerable expansion, so as to form a disc, on which it is said to be able to move; this foot is supplied with retractor-muscles, the im-

pression of which may be generally seen, one on each side and above the adductors, within the extended dental margin.

Although the mantle is generally open all round, the animal is capable of contracting or uniting the edges on one side, so as to form two openings, one for the incoming current and the other for the outgoing, being the commencement of the true siphons.

The known recent species of the genus are about sixty or seventy, and perhaps a similar number in the fossil state; these last are very difficult of determination, from the generally slight deviations in the form of the shell, the normal condition being nearly lenticular, the specific distinctions depending principally upon the sculpture of the surface or dental characters; but these teeth are very fallacious, as some are obliterated by age.

The peculiar form of these shells are favorable to their preservation, offering, as they do, a protection from mutilation, and specimens are often in high perfection.

The genus, in the recent state, has a wide geographical extension, but the species are somewhat restricted in their range; they are principally inhabitants of warmer regions, although *P. glycimeris* is living in the British seas, and *P. septentrionalis* in those of the north-west coast of America. A species found in the Eocene deposits of North America is said to be identical with one of our own fossils of the same age. It is most difficult, as before observed, to determine identity in shells of this genus; but, assuming it to be as so stated (which I much doubt), we may, I think, fairly place this species in the same category as *Terebratulina caput-serpentis*, *Kellia suborbicularis*, and many other living molluscs, whose localities at the present day are separated by apparently impassable barriers. We are not able now to trace these animals, whose localities are so unconnected, to what may be assumed as a common ancestry for each species thus identified. Whether these apparently identical forms are descendants of ancestors belonging to the same species once living together in close geographical contiguity, or whether they are forms having a distinct origin, but presenting no difference by which the malacologist can separate them from the typical species, we have at present not the materials to determine.

1. Pectunculus brevirostris, *J. Sowerby*. Tab. XVI, fig. 8.

Pectunculus brevirostris. *J. Sow.* Min. Conch., t. 472, fig. 1, 1824.
— — *Id.* in Dixon's Geol. of Suss., p. 225, t. 14, fig. 32, 1850.
— brevirostrum. *Morris.* Catal. Brit. Fos., p. 219, 1854.
— pulvinatus. *Mantell.* Geol. of Suss., p. 273, 1822.
Pectunculus. *Smith.* Strata Identif., t. 11, fig. 3, 1816.

Spec. Char. P. testâ suborbiculari vel obovatâ, convexo-lenticulari vix inæquilaterali, sub-symmetricâ; radiatim obsoletè costellatâ; concentricè striatâ; umbonibus brevibus depressis; areâ connexûs magnâ, areâ dentali arcuatâ; dentibus paucis magnis; marginibus crenulatis.

Shell suborbicular, slightly ovate, tumidly lenticular, nearly equilateral and symmetrical; covered with obsolete radiating ridges, and concentrically striated; beaks short or depressed; area of the connector large, dental margin curved, teeth few and large; margins crenulated.

Diameter, 2 inches.

Localities. Bognor (*Sowerby*), Reading (*Morris*).

This is a long and well-known shell at Bognor, where it has been found in abundance, with the valves generally united, and their ventral margins closed; the area for the ligament is rather wide, and ornamented with about half a dozen diverging depressed lines, and these oftentimes bear vertical strie, the impression of the linear composition of the ligament. The radiating rays of the exterior are broad and depressed, separated only by a thin, narrow line.

2. Pectunculus decussatus, *J. Sowerby.* Tab. XVI, fig. 7 *a—d.*

Pectunculus decussatus. *J. Sow.* Min. Conch, t. 27, fig. 1, 1812.
— — *Id.* in Dixon's Geol. of Suss., p. 116, t. 14, fig. 7, 1850.
— — *Smith.* Strata. Identif., t. 11, fig. 10, 1816.

Spec. Char. P. testâ suborbiculatâ vel obtusè et irregulariter quadrangulari, æquilaterali, tenui, depressiusculâ; radiatim costellatâ, concentricè striatâ, decussatâ; areâ connexûs bipartitâ; areâ dentali arcuatâ, multidentatâ; umbonibus acutis; marginibus integris.

Shell suborbicular or obtusely and irregularly quadrangular, equilateral, thin, and somewhat depressed; radiately striated, and decussated by lines of growth; area of the connector bipartite; dental margin curved and well filled with teeth; beaks sharp, margins smooth.

Length, $\frac{6}{8}$ths; *height*, $\frac{5}{8}$ths of an inch.

Localities. Highgate (*Wetherell*), Bognor (*Dixon*), Basingstoke (*Prestwich*), Clarendon, Haverstock Hill (*Edwards*).

This is abundant at Highgate, and Mr. Sowerby has figured a specimen from Bognor, where, I believe, it is rare. The specimens from Highgate are generally in a good state of preservation except at the umbones, nine tenths at least are there broken. The outline of this species is more quadrangular than in the generality of the genus, especially at the siphonilateral margin, and the shell is rather longer than it is high. The surface is prettily ornamented by the lines of growth, decussating the rays, by which they are made slightly nodulous; the radiating lines are occasionally distant, with one to three intermediate or smaller rays. The radiations of the mantle are generally impressed upon the interior of the shell, and the impressions of the adductors are very large. The area for the connector is somewhat peculiar, having a large obtusely angular depression, and it is bipartite, like that of *Limopsis;* this depressed ligament is strongly marked with lines at right

angles to the dental margin (fig. 7, *c*, *d*), showing the linear fibres of which it is composed, these being the more durable portion, are alone remaining. Fig. 14, Tab. XIX, is the representation of a young individual from Clarendon; it is of a rather more elongated form than the generality of the larger specimens, but its peculiarity is in the area for connexus, where it shows a bipartite character precisely resembling that which is considered a generic distinction in *Limopsis*; in this young shell the triangular cavity is not only small, but it is comparatively much less than in the adult shell. The connexion between the two genera in the immature state appears so close as not to permit of generic separation, showing, as in many other animals, a very near relationship in the early part of life, diverging by the increase of age.

Some of these young shells have the rays upon the exterior fewer and more prominent, resembling those upon *P. deletus*, the intermediate rays being small and scarcely perceptible; they are not peculiar to the Clarendon specimens, but may be seen also on young shells from Haverstock Hill. Casts resembling this species have been found at Sheppey.

3. Pectunculus deletus, *Solander*. Tab. XVI, fig. 3, *a*, *b*.

Arca deleta. *Solander*, in Brand. Foss. Hanton., p. 97, pl. vii, fig. 97, 1766.
Pectunculus costatus. *J. Sow.* Min. Conch., t. 27, fig. 1, 1813.
— deletus. *Morris*. Catal. Brit. Foss., p. 219, 1854.

Spec. Char. P. testâ orbiculatâ, convexâ, vel regulariter lenticulatâ; radiatim costatâ; costis æqualibus angustis, acutis ornatâ; concentricè striatâ; striis creberrimis; costis aliquando tuberculatis; umbonibus subelevatis, recurvis; cardine valdè arcuato, multidentato.

Shell orbicular, convex, or lenticular, radiately costated; ribs equal, sharp, and narrow; concentrically striated lines of increase numerous, close, ribs sometimes tuberculated; beaks slightly elevated, recurved; hinge-line with numerous teeth.

Diameter, $1\frac{3}{8}$ths of an inch.

Locality. Barton.

This is an abundant shell at Barton. I have not seen it from any other locality.

Some specimens are almost smooth, or at least are covered with only depressed rays, without the appearance of abrasion, others are beautifully ornamented with narrow sharp ribs, varying from twenty-five to thirty-five; and these are, in very well preserved specimens, covered with tubercles produced by the prominent lines of growth. The dental area is well furnished with a continuous line of teeth varying from twenty to thirty. The margin of the valves is regularly denticulated, and these are not the extension of the ribs, but appear to be quite independent.

A shell found by Herr A. von Koenen at Lattorf appears to agree with the smooth variety of this species.

4. Pectunculus globosus, *J. Sowerby*. Tab. XVI, fig. 9.

Pectunculus globosus. *J. Sow.* in Dixon's Geol. of Sussex, p. 170, t. 3, fig. 20, 1850.

Spec. Char. P. testâ crassâ orbiculari, globosâ, sub-æquilaterali, æquivalvi, lævigatâ, aut obsoletè radiatâ; margine cardinali arcuatâ, umbonibus prominentibus, marginibus crenulatis.

Shell thick, obliquely orbicular, globose, slightly inequilateral, equivalve, smooth, with faint or obsolete radiations; hinge or dental area curved; beaks prominent; margins crenulated.

Diameter, 1 inch.

Locality. Bracklesham (*Dixon*).

This appears to be more tumid at the upper part than any other species. There is a resemblance between it and *proximus*, which is common at Barton; but that shell is always more or less oblique, with a sharper or less tumid umbonal region, and this shell, as its name implies, is more globose.

5. Pectunculus Plumsteadiensis, *J. Sowerby*. Tab. XVI, fig. 6, *a*, *b*.

Pectunculus Plumsteadiensis. *J. Sow.* Min. Con., t. 27, fig. 3, 1813.
— — *Morris.* Catal. Brit. Foss., p. 219, 1854.

Spec. Char. P. testâ tenui, lenticulari vel orbiculato-subquadratâ, æquilaterali; obsoletè costatâ vel radiatâ, concentricè striatâ; umbonibus depressis; marginibus crenulatis; areâ connexûs parvâ.

Shell thin, lenticular, with a somewhat roundedly quadrangular outline; equilateral, obsoletely costated or radiated; beaks depressed, with a small area for the connector; margins toothed.

Diameter, 1½ inch.

Localities. Plumstead; Upnor; Katesgrove, near Reading.

This is thinner than the generality of the genus, and the rays upon the exterior are broad and rounded; it resembles *brevirostris* in having a small beak, but that shell is more oblique, with the rays less prominent, the hinge less curved, and the denticles fewer. In the 'Geol. Journ.,' vol. x, p. 120, 1854, this species and *brevirostris* are united with *P. terebratularis*, Lamarck. M. Deshayes (p. 852) considers the two latter as distinct, and I am disposed to agree with him, but I believe also that the above-named *Plumsteadiensis* is entitled to a distinct specific position.

6 Pectunculus proximus, *S. Wood.* Tab. XVI, fig. 5, *a—c.*

Spec. Char. P. testâ obliquè suborbicularè, inæquilaterali, crassâ, tumidâ; obsoletè costulatâ vel radiatâ; siphoni-regione subangulato; umbonibus prominulis; areâ connexis obtusè triangulari; dentibus numerosis.

Diameter, $1\frac{1}{8}$ inch.

Locality. Barton (*Edwards*).

This species differs from *P. pulvinatus,* with which it has been hitherto associated, in being more oblique, more elevated, and less tumid, and there is always a greater extension of the siphoni-lateral margin, with a depression or flattened space above a slight ridge, extending from the umbo on that side, particularly in elevated specimens. The shell in general has a greater diameter in the direction of its height, and in these specimens the ligamental area is larger or higher, with the dental margin broader than in others; but its principal distinction is the angular ridge on the siphonal side. Tab. XVII, fig. 11, is from Huntingbridge, and may, I now think, be referred to this species; it was at first supposed to be a *Limopsis,* but the character which induced that name is probably accidental; it is, however, smoother and thinner than the generality of the Barton specimens.

There are two or three species from the Paris basin to which our fossil bears a close relationship, but to no one of them can I satisfactorily assign it. *P. depressus* (Desh.) resembles it in outline, but our shell is neither depressed ("depressissima"), nor thin; it is crenulated all round, not "mince et lisse antérieurement et postérieurement:" neither is the "area ligamenti minima."

7. Pectunculus pulvinatus, *Lamarck.* Tab. XVI, fig. 2, *a, b.*

Pectunculus pulvinatus.		*Lam.* Ann. du Mus., t. vi, p. 216, and t. ix, pl. 18, fig. 9, *a, b.*
—	—	*Desh.* Par. Foss., p. 219, pl. 35, figs. 15—17.
—	—	*Ib.* Coq. Caract. des Terr., pl. 5, figs. 9, 10.
—	—	*Bronn.* Leth. Geogn., t. ii, p. 936, pl. 39, fig. 4.
—	—	*Goldf.* Petr. Germ., p. 160, No. 5, pl. 126, fig. 5.
—	—	*Nyst.* Belg. Foss., p. 250, pl. 19, fig. 8, *a, b.*
—	—	*J. Sow.* in Dixon's Geol. of Suss., p. 93, t. 11, fig. 25.
—	—	*Bronn.* Syst. der Urw., p. 52, pl. 5, fig. 13, 1824.

Spec. Char. P. testâ orbiculatâ, ventricosâ aut pulvinatâ, subæquilaterali vix obliquatâ. striato-costulatâ vel radiatâ, tenuè decussatâ; margine crenato, crenulis brevibus; areâ cardinali perangustâ, umbonibus depressis.

Shell orbicular or lenticular, ventricose or puffed up, nearly equilateral, slightly

oblique; radiated or obsoletely costulated, finely decussated; margin toothed, area of connector rather narrow; beaks depressed.

Diameter, 2 inches.

Localities. Stubbington (*Edwards*).

Belgium: Le calcaire d'Afflighem et d'Audenarde, Kleyn Spauwen (*Nyst*).

France: Grignon, Courtagnon (*Deshayes*).

A large number of fossils from various localities and from various formations have been figured and described under the above name; Brongniart has given it to a species from the neighbourhood of Turin, and Dubois to one from Volhynia, but these are, perhaps, not strictly within what are called specific limitations. The principal character, as its name imports, is a tumid or puffed-up appearance of the specimen, with a very slight deviation from the orbicular or rather circular form of the margins. There is also a slight angularity on the siphonal region, as is often the case in shells of this genus. The dental area is curved and well furnished with teeth, and the area for connexus is rather small, but it increases considerably as the shell enlarges, and it is comparatively wider in the old shell, where the ligamental portion of the connector has obliterated or overlapped the denticles in the centre of the hinge area. The surface of the English specimens is seldom or never in such a good state of preservation as those from the Paris basin, where the small interstices between the rays and the lines of growth may be distinctly seen, giving a slightly punctured appearance to the exterior, and in those shells a portion of the connector is often preserved.

8. Pectunculus quasipulvinatus, *S. Wood.* Tab. XVI, fig. 1, *a*, *b*.

Spec. Char. P. testâ lenticulato-complanatâ, compressâ, æquilaterali, æquivalvi, subtransversâ; radiato-striatâ, striis depressis, obsoletis; concentricè decussatâ; marginibus crenulatis; areâ connexûs perangustâ; umbonibus depressiusculis.

Shell compressed or depressedly lenticular; equilateral, equivalve, rather transverse or elongated; covered with depressed and obsolete striæ; decussated by obscure or irregular lines of growth; margins crenulated; area of connector narrow; beaks depressed.

Diameter, $2\frac{1}{8}$th inches.

Locality. Bracklesham.

This has hitherto been placed in cabinets under the name of *P. pulvinatus*, var., but I think the differences are such as to entitle it to a separate specific position, and the specimens themselves appear to show a permanence of difference which give them as good a claim for isolation as most others in this perplexing genus. Our shell is much more compressed than the true *pulvinatus*, and the proportions in this are also different, the shell being more transverse or elongated. It differs also from the French shell called *pseudopulvinatus*, which is neither so compressed nor so transverse as our present species. I

have separated the two British shells in consequence of the very great difference in the tumidity or convexity displayed between them, and this difference appears to be constant. The Stubbington shell measures $2\frac{1}{10}$th inches in diameter, with $1\frac{3}{8}$ths inch in depth or tumidity of the united valves, while the Bracklesham shell is longer than it is high, and it has a depth of less than an inch between the inflation of the two valves. There is also a difference in the hinge; this latter shell has a narrower dental area, with a place for connexus also smaller.

9. Pectunculus spissus, *S. Wood.* Tab. XVI, fig. 4, *a*, *b*.

Spec. Char. P. testâ spissâ, tumidâ, globosâ, orbiculari, æquilaterali; radiatim obsoletè costellatâ, costis depressis; umbonibus prominentibus; areâ connexûs elongato-trigonatâ, profundè sulcatâ; margine dentali crassâ, dentibus quatuor ad quinque, utroque latere transversalibus crassiusculis; marginibus irregulariter crenulatis.

Shell thick, tumid, globose, orbicular, equilateral, with depressed and obsolete ribs; beaks prominent, area of connector broadly triangular, with deep chevron-formed lines; dental margin thick, with 4 to 5 teeth on each side, inclining towards the extremities; interior margins irregularly crenulated.

Diameter, $1\frac{1}{4}$ inch.

Locality. Southampton (*Edwards*).

This species, I believe, is not rare; I have seen it only from one locality, and the specimens appear to be nearly all of the same magnitude, as if the full-grown shell, which I presume it to be, did not exceed the above dimensions. I have ventured to propose for this a new specific name, considering the characters to differ from those of any other species. The nearest to which it approaches is *P. globosus* of the Bracklesham beds, but from which it appears to differ in having a more prominent umbo, and that shell has a more thickened dental area, with fewer teeth.

10. Pectunculus terebratularis, *Lamarck.* Tab. XVI, fig. 10.

Pectunculus terebratularis. *Lamk.* Ann. du Mus., t. vi, p. 217, No. 3.
— — *Desh.* Coq. foss. des Env. de Par., t. i, p. 221, pl. 35, figs. 10, 11, 1829.

Spec. Char. "*P. testâ orbiculatâ, subæquilaterâ, ventricosâ, cordatâ, incrassatâ, radiatim sulcatâ, sulcis planiusculis decussatis, cardine lato paucidentato; dentibus lateralibus striatis.*"

Shell orbicular, nearly equilateral, ventricose, heart-shaped, thick, covered with radiating

striæ or depressed riblets decussated by lines of growth; hinge-area broad, with few teeth, lateral denticles striated.

Diameter, 2 inches.

Localities. Herne Bay (*Edwards*), Upnor (*Prestwich*).

France: Les environs de Soissons, près d'Etampes, &c. (*Desh.*).

The most distinguishing character in this species is a prominent or rather recurved umbo, somewhat resembling the beak of a *Terebratula*, which, I presume, suggested the name to Lamarck.

Fig. 10, Tab. XVI, represents a shell that was some years since obligingly given to me by Professor Morris, and it had the locality of Ilford attached to it, but that gentleman is now unable to state from what bed it was derived. It was accompanied by a *Cytherea* from the same locality, and this latter species I have since obtained from the Woolwich beds underlying the London Clay, reached in a well-sinking at Romford. There is therefore every probability that our specimen came from the same bed at Ilford. I am unable to assign this specimen to any species known to me, unless it might perhaps be referred to *brevirostris*, but with which it does not strictly accord. *P. polymorphus* also much resembles it.

A shell from the Paris Basin has been figured and described under the name *P. paucidentatus* (Desh.), 'An. sans Vert. du Bass. de Par.,' t. i, p. 852, pl. 73, f. 16, 17, which has the locality of Woolwich attached to the description. I have not been able to find any British specimen entitled to that distinction.

LIMOPSIS, *Sassi*, 1827.

Gen. Char. Shell orbicular or slightly oblique, convex or lenticular, equivalved, subequilateral, closed; hinge with two slightly curved and slightly unequal series of projecting and interlocking teeth; umbones distant; connexus ligamental, bipartite, one portion inserted in a triangular cavity immediately beneath the umbo; impression of the mantle entire.

The animal of one species of this genus (*L. aurita*) has lately been obtained in the seas of North Britain by Mr. Jeffreys, the account of which has been published in the 'Ann. and Mag. Nat. Hist.,' 1862, and he says "the body is of a milk-white colour. The mantle is open at every part except behind; it has no folds or tubes, and its edges are thickened and furnished with papilliform glands. The foot is large in proportion to the rest of the body, and it is shaped like a tobacconist's knife; it can, in all probability, form a suboval disc at the central portion, as in *Pectunculus*." It so much resembles that genus that the only distinction on which a separation can be founded is the triangular fossette in the area for connexus, and this cannot be considered a very important one, as it is present upon the young shell of *Pectunculus decussatus*.

Some Eocene fossils have been figured and described by MM. Nyst, d'Archiac, and Bellardi, under the generic name of *Stalagmium*, strongly resembling aberrant forms of this genus; they differ, however, slightly in the dental area, the central portion being much broader than in *Limopsis*, where the triangular fossette has pushed forward the ligamental connector, so as to diminish materially the dental line beneath the umbo. In those shells called *Stalagmium* there is an absence of the external triangular fossette, the connector being situated in a linear depression on one side only of the umbo, differing also in that respect from *Pectunculus*, which it otherwise somewhat resembles; the ligamental area is ridged or furrowed like most of the shells of this family. If these differences be considered sufficient to constitute generic distinction, those shells must be denominated *Stalagmium*, Nyst, as the genus proposed by Messrs. Lea and Conrad is untenable for the American Eocene fossil, which, as before stated, is a species of *Modiola* or *Crenella*.

1. Limopsis granulata, *Lamarck*. Tab. XVII, fig. 10, *a*, *b*.

Pectunculus granulatus.		*Lamk.* Ann. du Mus., t. vi, p. 117, No. 4, and t. xi, pl. 18, fig. 6, *a*, *b*.
—	—	*Desh.* Coq. foss. des Env. de Par., t. i, p. 227, pl 35, figs. 4—6, 1829.
Limopsis	—	*Prestwich*, Geol. Journ., 1847, p. 404.
—	—	*J. Sow.* in Dixon's Geol. of Sussex, pp. 93, 170, t. 3, fig. 19.
—	—	*Desh.* An. sans Vert. du Bass. de Par., t. i, p. 842, 1859.

Spec. Char. Testâ orbiculatâ, lenticulari, convexâ; subæquilaterali; decussatim striatâ; striis longitudinalibus angustioribus granulosis; cardine recto, umbonibus minimis; marginibus obsoletè crenulatis.

Shell orbicularly lenticular, convex, slightly inequilateral, striated or radiated and decussated; radiations fine and granular; hinge straight, umbones small, depressed; margins obsoletely or irregularly crenulated.

Diameter, $\frac{1}{2}$ an inch.

Localities. Bracklesham (*Edwards*).

France: Grignon, Parnes, Senlis (*Deshayes*).

This is a rare species in England, and found only at the above locality; it is said to be abundant in the Paris Basin.

The surface of this shell is covered with fine, small, radiating striæ, which are crossed or decussated by prominent lines of growth; the conjunction of these two lines causes an elevation, thus giving a granular surface to the exterior; the shell is nearly lenticular and equilateral, the diameter being, as near as possible, the same in each direction, though occasionally it is a trifle in excess in the height. The hinge is furnished with three to five denticles on one side of the umbo, nearly vertical, and on the other from five to six in a curving direction, and the interior margin is faintly and somewhat irregularly denticulated.

The upper part of the hinge-line is nearly straight, which gives a small shoulder to the shell on each side. *Trigonocœlia granulata*, Nyst, 'Coq. foss. Belg.,' p. 241, pl. 19, fig. 1, strongly resembles our shell by figure and description; but M. Deshayes, who, I presume, has examined the Belgian fossil, says it is specifically different. The artist has given rather too much obliquity to our figure.

Limopsis Belcheri, Adams and Reeve, is said by Mr. Jeffreys, 'Ann. and Mag. Nat. Hist.,' 2nd ser., vol. x, p. 345, Nov., 1862, to be the same as the Eocene species.

2. Limopsis scalaris, *J. Sowerby*. Tab. XVII, fig. 9, *a*, *b*.

Pectunculus scalaris. *J. Sow.* Min. Conch., t. 472, fig. 2.
— — *Morris.* Catal. Brit. Foss., p. 207, 1854.

Spec. Char. Testâ orbiculatâ, convexâ, inæquilaterali obliquâ; radiatim costulatâ, et concentricè striatâ, decussatâ; costulis granulatis, angustis, separatis; cardine obliquo; umbonibus parvis; marginibus crenulatis.

Shell orbicular, convex, inæquilateral, oblique, radiatedly costulated and decussated by lines of growth; rays rough, subgranular; hinge oblique; umbones small; margins crenulated.

Diameter, $\frac{3}{8}$ths of an inch.

Locality. Barton.

This is an abundant shell at Barton, where the two valves are often found united. The exterior of this species is prettily ornamented with about twenty-four or twenty-six prominent rays, or rather acutely angular costæ, with often an intermediate ray, sometimes two; these rays are cut or crossed by prominently rounded ridges of growth, which decussate the surface, and produce a nodulous appearance on the rays, like the exterior of *Pectunculus deletus*. "The transverse lines between the ribs resemble the steps of a rope-ladder."—*J. Sowerby*. The hinge-margin is furnished with about five to eight prominent teeth, placed at nearly right angles to the hinge-line on the pedal side, and about nine to twelve in a curving direction on the other. The interior of the entire margin is irregularly denticulated, but not at the extreme edge. The triangular fossette in the area of connexus is large and deep, diverging from the umbo at nearly a right angle.

TRIGONOCŒLIA. *Deshayes.*

Generic Character. Shell equivalve, generally small, inequilateral; more or less trigonular or deltoidal; pedi-lateral margin rounded, siphoni-lateral angular; umbones prominent, ventral margin smooth; hinge-line divergent, with sharp and generally angular

and prominent denticles, divided into two portions; connexus ligamental, placed in a triangular fossette; two adductor-muscles; impression of mantle without a sinus.

The connector being situated entirely on the outside of the dental apparatus, concentrated in a triangular cavity and opening the valves by contraction, is a sufficient character to entitle these shells to be placed in a distinct generic position. This triangular fossette bears a resemblance to that upon *Limopsis*, but there is no extended area or bipartite division of the connector, as in that genus.

M. Nyst proposed the name *Trigonocœlia* for those bivalves which resembled *Pectunculus*, but differed in the disposition of the connector, as before remarked. *Trigonocœlia*, therefore, from want of priority, had lapsed into a synonym. M. Deshayes has employed the above name for his genus, as the type species had been called *Trigonocœlia* by M. Nyst.

The present genus is an emanation from *Limopsis*, differing from it by the loss of the expanded ligamental area, approaching closely to *Leda* in the form of the shell. The animal is at present unknown, but from its pointed siphonal region it probably possessed incipient siphons.

A few species only of this genus have been described; six of these are from the Paris Basin, and one has been figured by Mr. Lea from the Eocene deposits of America; these, with the British species, are all confined to the older Tertiaries. The animals appear to have been capable of firmly closing their valves; they have large and well-marked impressions of the adductors.

1. Trigonocœlia deltoidea? *Lamarck.* Tab. XIX, fig. 11, *a*—*c*.

Nucula deltoidea? *Lamk.* Ann. du Mus., t. vi, p. 126, and t. ix, pl. 18, fig. 5.
— — *J. Sowerby.* Min. Conch., t. 554, fig. 1.
Limopsis deltoidea? *D'Orb.* Prod. de Paléont., t. ii, p. 389, No. 1019.
Leda deltoidea. *Morris.* Catal. Brit. Foss., p. 205, 1854.
Trigonocœlia deltoidea? *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 840, 1858.

Spec. Char. T. testâ trigonâ vel deltoïdeâ, tumidâ, crassiusculâ, subæquilaterali, concentricè striatâ; pedi-regione rotundatâ, obsoletè radiatâ; siphoni-regione angulatâ, et carinatâ; umbonibus magnis prominentibus; cardine arcuato, dentibus 5 *vel* 6 *utroque latere; fossulâ connexûs profundâ, triangulari.*

Shell trigonal, tumid, rather thick, nearly equilateral; concentrically striated; pedal region rounded and obsoletely rayed; siphonal region angulated and keeled; beaks large and prominent; hinge-line curved, furnished with 5 or 6 denticles on each side; depression for connector deep and triangular.

Length, $\frac{3}{16}$ths inch; *height*, $\frac{1}{10}$th inch.

Localities. Barton (*Edwards*), Hordle (*S. Wood*), Shapley Heath (*Morris*).

This species appears to be restricted to the uppermost deposits; I have not seen it from below the Barton beds. It is not rare, though by no means so abundant as the Paris Basin shell. On comparing the British fossil with the French species, the following differences may be observed. Our shell is shorter, more elevated, and more regularly ribbed in the direction of the lines of growth; the angle on the siphonal region is sharper and more distinct, and there are only small, fine, and very faint rays upon the edge of the pedal region, whereas in the French shell these rays are few, large, sharp, and very prominent. The exterior of our shell has faint radiating lines, only perceptible in very perfect specimens, and by the assistance of a magnifier; they are most distinct on the siphonal region, particularly beyond the angular slope near the siphoni-lateral margin. The number of denticles are fewer in our shell than in the French specimens. It may be called var. *deltæ-formis*.

2. Trigonocœlia cancellata, *Deshayes*. Tab. XIX, fig. 12.

Trigonocœlia cancellata. *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 838, pl. 64, figs. 31—35, 1860.

Spec. Char. T. "*testâ transversim trigonâ, inflatâ, subæquilaterali, antice obtusâ, postice acute angulatâ, striis longitudinalibus, transversalibusque, elegantèr decussatâ, ad latus anticum longitudinalibus, proeminentioribus, distantioribus; latere postico plano, ovato, angulo, acuto, aliquantisper proeminenti separato, liris tenuibus distantibus ornato; cardine brevi, angusto, paucidentato; dentibus minimis, sæpius complicatis, fossulâ ligamenti satis latâ, regulariter triangulari.*"—Desh.

Shell elongately trigonular, slightly inflated; subequilateral; pedal region the larger, somewhat inflated; pedilateral margin rounded; siphonal region slightly compressed, angular, with pointed termination; exterior radiated and decussated by prominent and regular lines of growth; hinge-area small, denticles few; depression for connexus broadly triangular and shallow.

Length, $\frac{1}{2}$ an inch.

Localities. Huntingbridge.

France: Parnes, Damery-Auvers, Acy, Mary, Caumont, Crouy, La Ferté-sous-Jouare, Le Fayel (*Deshayes*).

A single specimen only of this species has been obtained by Mr. Edwards, and that unfortunately is not quite perfect; a part of the hinge-area has been destroyed, but the exterior and general contour of the shell correspond with the French species, and it may fairly remain with the above name for the present. It is quite distinct from our *deltoïdea*.

NUCULA. *Lamarck.*

Generic Character. Shell ovately trigonal or nut-shaped, smooth, or occasionally sculptured; nacreous, inside iridescent; siphonal region short or truncated; the umbones never prominent; hinge with a row of more or less numerous angular and elevated interlocking teeth; connexus cartilaginous; palleal line simple.

Animal of the shape of the shell; margins of the mantle disconnected all round; foot large, capable of being expanded into a disc, and ornamented with fimbriated edges.

The peculiarity of this genus consists in having the larger portion of the shell on the pedal side, and the umbo pointing in the opposite direction, an arrangement contrary to that which prevails in the generality of bivalves, and also in having the spoon-shaped projection within the hinge-margin, on which is placed the cartilaginous connector on the pedal side of the umbo. The hinge-line forms nearly a right angle, but this diverges into an obtuse one in the aberrant species, where an extension of the shell, on the verge of the genus, approaches the ovate or elongated form of *Leda*.

The animal of this genus, the inhabitant of the shell which is the type, is said not to have any siphons, and that the margins of the mantle are disconnected. In the approximating genus *Leda*, the mantle in the siphonal region is connected so as to form two distinct tubes, which are capable of considerable exsertile extension. The animal of *Nucula* proper has the mantle open all round; but in those species which have an extension on the siphonal side approaching *Leda*, it will probably be found that the margins of the mantle in the siphonal region are partly connected, so as to separate the incoming from the outgoing current.

In this genus the greater number of the fossil species have the interior or ventral margins of the shells ornamented with crenulations. These crenulations are found in those species only in which the exterior of the shell is covered with radiating lines; they are apparently due to the fimbriated edges of the mantle, and do not extend to the edges of the dorsal margins, even where the area of dentition is limited. The ventral margins of the mantle in *N. nucleus* are said to be plain; but I imagine they must be very finely fimbriated, in order to deposit the elevated layers of shelly matter which produce the radiations. These rays are most conspicuous upon the under surface, which is sometimes covered over with a coating of enamel-like material, so as to obliterate or at least to obscure the rays; but when the margins are crenulated, I presume they will always be more or less visible.

The shells of the species which have the margins smooth will be entirely free from radiating striæ, and the edges of the mantle of those animals are probably quite plain.

The shells in the living state are covered with an epidermis, remains of which may be occasionally observed upon specimens of the Eocene deposits. Some have their radiations strongly decussated by elevated lines of growth; a few species also have a peculiar ornament in a zigzag form, and for these a sub-genus has been proposed, under the name *Acila*,

by Messrs. Adams. I have not seen this kind of sculpture upon any Eocene fossils. In this genus it is often difficult to determine, in descriptions, which part is intended for the "anterior," as that term is applied sometimes to the shorter, at others to the longer division of the shell.

It has been generally supposed that the species of *Nucula* are well defined and easily determined, but I am sorry to say, they have not appeared so to me. The Eocene species have given me more trouble in their assignment than those of almost any other genus, and the result is not at all satisfactory to myself; it will be fortunate for me if I be the only one of that opinion. The Eocene shells of this genus found in England, and here illustrated, present a great variety of forms, most of which I have considered as entitled to specific distinction; it is however possible, that with a larger amount of materials, some of these lines of division might disappear.

1. Nucula ampla, *Edwards*, MS. Tab. XVIII, fig. 5, *a*, *b*, var. fig. 6, *a*, *b*.

Spec. Char. N. testâ transversâ, ovato-subtrigonulâ vel nuciformi, amplâ, tumidiusculâ, crassâ, lævigatâ; pedi-regione latiore; ano-regione paulo attenuatâ, rotundatâ; margine dorsali convexiusculâ; margine ventrali plùs convexâ; lunulâ elongato-lanceolatâ; dentibus ad apicem gradatim minutis; marginibus crenulatis.

Shell transverse, ovately trigonular or nut-shaped, broad, somewhat tumid, thick, smooth; pedal region the broader; anal region slightly projecting and rounded; dorsal margin slightly convex, ventral margin more rounded; lunule elongated; denticles diminishing towards the apex; margins crenulated.

Length, $\frac{1}{2}$ an inch.

Locality. Barton (*Edwards*).

This species, I believe, is not very rare. Its peculiar or specific distinction is the roundedly ovate form, which appears to be more so than in any other species I have seen. The anal region is much rounded, and the dental area on that side short, by which is given a greater convexity to the ventral margin. It has an elongated indistinct lunule or dorsal depression, with a slightly elevated corselet surrounded by a depression; it bears some resemblance to *N. lunulata*, Nyst, but it appears to differ from that species in having both dorsal and ventral margins more curved, and it has not so distinct and prominent a corselet as that species. The interior is sometimes much thickened, and the adductor marks are deep; there is also an elongated impression of the pedal muscle near the oral adductor, beneath the dental margin, and generally in thickened specimens an upright visceral (?) impression. Fig. 6, *a*, *b*, in same plate, represents a specimen in Mr. Edwards's cabinet with the MS. name of *contigua*; in this there is a slight difference in the contour, and in the anal region, but I think it is scarcely entitled to specific distinction. I have therefore considered it only as a variety of the above species.

2. Nucula bisulcata, *J. Sowerby*. Tab. XVIII, fig. 13, *a—c*.

Nucula bisulcata. *J. Sow.*, in Dixon's Geol. of Sussex, pp. 93, 170, t. 2. fig. 13. 1850.
— — *Morris*. Catal. Brit. Foss., p. 217, 1854.

Spec. Char. N. testâ ovato-subtrigonâ, elongatâ, crassâ, lævigatâ; pedi-regione ellipticâ, longiore et altiore; siphoni-regione angulatâ, subproductâ, compressiusculâ; lunulâ elongato-lanceolatâ, bisulcatâ; ano ovato, in medio prominente; dentibus ad apicem gradatim minutissimis; marginibus integris.

Shell ovately sub-trigonular, elongated, thick, compressed, smooth; pedal region elliptical, margin ovately rounded; siphoni-lateral margin angulated, compressed, and slightly produced; lunule elongately lanceolate, with a central ridge; anal region ovate, prominent in the centre; teeth diminishing towards the umbo, ventral margin smooth.

Length, 1½ inch; *height*, 1 inch.

Localities. Barton, Bracklesham.

Specimens of this species are not very abundant, and have, I believe, been as yet only found at the above localities.

The shell is nearly smooth, with the exception of distinct lines of growth. The dorsal margin has a sort of flattened space (lunule), with a central elevation or ridge, on each side of which is a depression or furrow, giving a sinuation to the pe li-lateral margin, and to this peculiarity of character the species owes its name. The muscle-marks are both deeply impressed, the anal one more especially so; it is of an elongated form, pointed towards the umbo, and there is also an impression in the umbonal region, probably left by the retractors of the foot. The teeth are not numerous, about a dozen on the pedal side, and half that number on the other. The shell in the living state was probably covered with a thick epidermis; traces of this may be seen on many specimens. The nearest approach to this is a recent species, *N. Cumingii*, from the Indian Archipelago, but from which it differs, according to description, in not having the lunule with a bipartite division.

3. Nucula Bowerbankii, *J. Sowerby*. Tab. XVIII, fig. *f*, 14, *a*, *b*.

Nucula Bowerbankii. *J. Sow.* Geol. Trans., 2nd series, vol. v, t. 8, fig. 11, 1834.
— — *Prestwich*. Geol. Journ., 1847, p. 405.
— — *Morris*. Cat. Brit. Foss., p. 217, 1854.

Spec. Char. N. testâ latè ovatâ, subtrigonâ, valdè inæquilaterali, convexâ, radiatim striatâ; striis depressis, latis, approximatis; siphoni-regione obliquè truncatâ; lunulâ elongato-lanceolatâ vix perspicuâ; marginibus crenulatis.

" Elliptical, convex, smooth externally, striated within; anterior (?) extremity obliquely

truncated; the slope filled by a large, pointed, nearly flat lunette, edge toothed; impression of the abductor muscles shallow."—(*J. Sowerby*).

Length, 1 inch; *height*, $\frac{3}{4}$ths of an inch.

Localities. Highgate, Potter's Bar (*Wetherell*); Haverstock Hill (*Edwards*).

This species was apparently covered by a thick epidermis, and the umbones have been very much eroded. The anal region or corselet is well marked and flat, with a slight rise in the centre, and covered only by lines of growth. The surface of the shell is smooth to the unassisted eye, but it is covered with narrow, deep, radiating lines, making the rays broad and flat, and there is a depression on the dorsal portion of the pedal region irrespective of the lanceolated lunule, as if the ventral margins were capable of being widely separated. The species appears to be confined to the London Basin.

The interior cast of a shell of this genus is figured and described in the 'Trans. of the Geol. Soc.,' 2nd series, vol. v, pl. 24, fig. 5, under the name *N. Baboensis*, and is said by the author to "nearly resemble *N. Bowerbankii*, but not truncated or pointed below the lunette." This specimen came from Baboo Hill in Cutch, and it is in that easterly direction that we might look, I think, for shells probably identical with some of our own Eocene fossils, but I fear it is not possible to certify a species by the cast alone. There is also the cast of a species in this genus found in the Eocene Formation, between Holyport and Birfield; the specimen was deposited in the Museum of the Geological Society, by the late Mr. Warburton (marked No. 17839), and has a somewhat similar form, but it presents the same difficulty for determination, and I am unable to assign it to any species; these various casts do not show whether the inner margins were furnished with crenulations.

4. Nucula cardioides, *Edwards*, MS. Tab. XIX, fig. 8.

A single specimen from Pegwell Bay, in the cabinet of Mr. Edwards, has the above name attached to it, and it appears to belong to a distinct species; but it is very imperfectly preserved, and I am unable to describe its true characters. The shell is externally rayed with distinct and well-marked striæ or riblets, and the inner margin is crenulated. Its present name must be considered provisional.

5. Nucula compressa, *J. Sowerby*. Tab. XIX, fig. 5.

Nucula compressa.	*J. Sow.*	Geol. Trans., vol. v, 2nd ser., p. 136, pl. 8, fig. 14, 1834.
—	—	*Prestwich.* Geol. Journ., 1847, p. 405.
—	—	*Morris.* Catal. Brit. Foss., p. 217, 1854.

Spec. Char. N. testâ, elongato-ovatâ, turgidâ, tumidâ, inæquilaterali; lævigatâ, glabrâ, margine dorsali subrectâ, pedi-regione ovatâ; siphoni-regione, prælongâ, subrostratâ; margine ventrali convexâ; lunulâ vix conspicuâ; apicibus depressis; marginibus integris.

Shell elongately ovate, inflated, inequilateral, smooth and glossy; dorsal margin nearly straight; ventral margin convex; pedal region large, ovate; siphonal region obtusely pointed; lunule inconspicuous; beaks depressed; margins smooth.

Length, $\frac{9}{10}$ths of an inch; *height*, $\frac{5}{10}$ths of an inch.

Locality. Hampstead Heath (*Wetherell*); Potter's Bar, and Highgate (*Edwards*).

The peculiar distinction is the pointed or subrostrated form of the siphonal region, where it is slightly compressed, from which I presume it received its name, as the shell is otherwise rather tumid.

6. Nucula consors, *S. Wood.* Tab. XIX, fig. 7, *a*, *b*.

Nucula similis. *J. Sow.* Min. Conch., vol. ii, p. 207, t. 192, figs. 3, 4, 1819.

Spec. Char. N. testâ obovatâ, transversâ, subtrigonulâ, turgidâ, valdè inæquilaterali, obsoletè radiatâ, aliquantisper striis transversis decussatâ; pedi-regione prolongâ, obtusâ; siphoni-regione rotundatè truncatâ; margine ventrali convexâ; lunulâ vix distinctâ; ano ovato in medio prominenti; marginibus crenulatis.

Shell transverse, obtusely ovate, roundedly trigonal, turgid, very inequilateral, obsoletely rayed, slightly decussated by lines of growth; pedilateral margin obtusely or roundedly angulated; dorsal and ventral margins convex; lunule indistinct; anal region slightly prominent; internal margins crenulated.

Length, $\frac{1}{2}$ an inch; *height*, $\frac{3}{8}$ths of an inch.

Locality. Highgate (*Wetherell*).

Many specimens of this species are in the cabinet of Mr. Wetherell; but they are seldom in good condition, the greater number of them being merely casts.

Professor Morris, in his 'Catalogue of British Fossils,' has rejected figs. 3 and 4, t. 192, 'Min. Conch.,' from being identical with the Barton species figured upon the same plate, and Mr. Sowerby says, at p. 208, he is doubtful whether fig. 4 ought not to be considered a distinct species, or at least a distinct variety, implying thereby a doubt as to the propriety of admitting it under the name of *similis*. I have, therefore, given it a new specific name with more confidence, having the support of the above two opinions. It resembles in many of its characters one or two species from the Middle Eocene, but with none does it appear to be truly identical. It has no distinctly marked lunule. There is a prominent anal region surrounded by a depression, and in those specimens which are best preserved the radiating striæ are very distinct, decussated by lines of growth. The two valves are most commonly united, and many of them have been perforated by a zoophagous feeder.

Fig. 3 in 'Min. Conch.' is more angulated than fig. 4, but I think they both belong to the same species, as there is considerable variation in the outline among Mr. Wetherell's specimens.

7. N. CURVATA, *Edwards*, MS. Tab. XVIII, fig. 12, *a*, *b*.

Spec. Char. N. testâ transversâ, ovato-subtrigonulâ, tumidiusculâ, crassiusculâ, obsoletè radiatâ, radiis vel striis tenuissimis; valdè inæquilaterali; pedi-regione angulatâ, productâ; ano-regione brevi, in medio prominenti; margine dorsali sub-rectâ; margine ventrali convexiusculâ; lunulâ lanceolatâ vix conspicuâ; marginibus crenulatis.

Shell transverse, ovately trigonular, slightly tumid, and moderately thick; obsoletely radiated with very fine lines or striæ; pedal region produced and angulated; anal region short, and rather prominent in the centre; dorsal margin nearly straight, ventral margin curved; lunule scarcely conspicuous, margins crenulated.

Length, $\frac{3}{8}$ths of an inch.

Locality. Clarendon (*Edwards*).

This species is at present very rare. It somewhat resembles *N. sphenoides*, but it is comparatively longer; it is more produced and angular at the pedilateral margin, and it is less tumid than the Upper Eocene shell.

Two or three specimens in Mr. Prestwich's cabinet, obtained from a boring for an Artesian well at Southampton, appear to belong to this species; the age of the bed from which they came is not stated.

8. NUCULA DIXONI, *Edwards*, MS. Tab. XVIII, fig. 7, *a*—*c*.

NUCULA SIMILIS. *J. Sow.*, in Dixon's Geol. of Suss., p. 93, t. 2, fig. 7, 1850.

Spec. Char. N. testâ ovato-subtrigonulâ, turgidâ, lævigatâ, valdè inæquilaterali, convexâ; siphoni-regione truncatâ; lunulâ obtusè angulatâ vix perspicuâ; cardine crassâ, dentibus magnis; fossulâ connexûs elongatâ; marginibus crenulatis.

Shell ovately triangular, somewhat tumid, smooth, convex, very inequilateral; siphonal region truncated; lunule and corselet not very distinctly defined; teeth thick and broad towards the connector, margins crenulated.

Length, $\frac{7}{8}$ths of an inch; *height*, $\frac{11}{16}$ths of an inch.

Localities. Bracklesham, Stubbington, Whitecliff Bay (*Edwards*).

This species is by no means rare at Bracklesham. It appears to differ from *similis* in being more tumid and less angular, and rather more elongated, and it has not the projecting pointedness at the basal margin of the siphonal region which is characteristic of that species. The exterior is more convex, and the radiating lines are less distinct in this than they are

in *similis*, which is its nearest relative. It bears a strong resemblance to *N. margaritacea* of Nyst, 'Coq. Foss. Belg.,' p. 229, pl. xvii, fig. 9, *a*, *b*, but the dorsal margin of that figure is rather more curved. *N. margaritacea*, Goldf., 'Petr. Germ.,' vol. i, p. 158. t. 125, fig. 21, *a—d*, also much resembles it.

Some specimens in Mr. Edwards's cabinet from the same locality have attached to them the MS. names of *quadrans*, Tab. XVIII, fig. 8, *a*, *b*, and *planiuscula*, same plate, fig. 9; they differ in outward form, as those names indicate, but I think they are varieties of the above. It is possible they may prove to be distinct.

9. Nucula Headonensis, *Forbes*, MS. Tab. XVIII, fig. 3, *a*, *b*.

Nucula Headonensis. *Morris*. Mem. Geol. Surv., p. 156, pl. 6, figs. 12, 12, *a*, *b*, 1856.
— — *Id.* Catal. Brit. Foss., p. 218, 1854.

Spec. Char. "*Testâ ovato-transversâ, depressâ, lævi, latere antico brevi, subproducto, margine arcuato, posticè angusto, margine ventrali subarcuato, intus crenulato; lunulâ prominulâ, sulco perspicuo circumdatâ.*"

"An ovately transverse and somewhat depressed shell, with the anterior margin short and slightly produced, the posterior extremity narrowed, the ventral margin arched and internally very finely crenulated; the lunule prominent, and surrounded by a conspicuous furrow."—*Morris*.

Length, $\frac{3}{8}$ths of an inch.

Localities. Colwell Bay, Headon Hill (*Morris* and *Edwards*), Hordwell (*S. Wood*).

This species has been separated from *similis* by the late Edward Forbes; it has also been considered by Mr. Morris as distinct, and I readily acquiesce in the separation. Specimens are not particularly rare, and are found often in a very perfect state of preservation. It somewhat resembles in outline *N. Dixoni*, but it is a smaller species; the siphonal region is shorter, and the basal extremity on that side is more rounded, and it appears also to be a thicker shell. In the 'Catal. Brit. Foss.,' p. 218, 1854, *Nucula similis*, Wood, is given as a synonym to this species, but I have not been able to find the reference.

10. Nucula lissa, *Edwards*, MS. Tab. XVIII, fig. 4, *a*, *b*.

Spec. Char. N. testâ elongato-ovatâ, tenui, lævi, glabrâ, compressiusculâ, inæquilaterali; pedi-regione latiore, ovatâ: siphoni-regione obliquè truncatâ, subrostrata; marginibus dorsali et ventrali convexis; lunulâ lanceolato-elongatâ, depressâ; ano cordiformi; dentibus ad apicem gradatim minutissimis; marginibus integris.

Shell elongately ovate, thin, smooth, and glossy, slightly compressed, inequilateral; pedal-region the wider and ovately rounded; siphonal region obliquely truncated; dorsal

and ventral margins curved; lunule elongate, distinct, and rather depressed; anal region heartshaped; teeth small near the beak; margins smooth.

Length, $\frac{1}{2}$ an inch; *height*, $\frac{5}{10}$ths of an inch.

Localities. Highcliff, Barton, Brockenhurst, Hordwell (*Edwards*).

Although a thin and delicate shell, it has been obtained by Mr. Edwards in great abundance. The exterior is smooth and glossy, with a few concentric ridges or obtuse lines of growth. The interior has a strong nacreous lustre, with an enamelled exterior. The hinge-line is narrow; it has about a dozen denticles on the pedal side, with scarcely half that number on the other, and the support for cartilage is simple, somewhat elongated, projecting inwardly at an angle of 45° to the dorsal margin. There is a deep depression (lunule?) on the pedal region, producing a sharp elevation to the dorsal margin, with a faint depression on the siphonal or anal region, but not very well defined. The extremity of the siphoni-lateral margin is rather short and generally more or less pointed or subrostrated; this gives a considerable convexity to the ventral margin in the normal form. The shell is thin, and the oral muscle scarcely visible, but the anal one is large and well impressed.

There are, I think, three varieties of this species; at least, there are three different forms, which I have referred to the above name, presenting as they do considerable difference in outline, but not, I think, sufficient to entitle them to different specific positions. Tab. XX, fig. 1, *a*, *b*, *c*.

11. Nucula minor, *Deshayes*. Tab. XVIII, fig. 10.

Nucula minor. *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 823, pl. 64, figs. 17—20, 1860.

Spec. Char. N. "testâ minimâ, ovato-trigonâ, turgidula, valdè inæquilaterali; posticè transversim truncatâ; supernè declivi; anticè attenuatâ, transversim tenui-sulcatâ: sulcis anticè paulo undulatis; lunulâ nullâ; ano plano, non circumscripto; cardine angusto, pauci dentato; dentibus angustis distantibus; fossulâ minimâ, brevi, angustâ; marginibus sublente minutissimè crenulatis."—Desh.

Shell small, ovately trigonular, slightly tumid, siphonal region short, obliquely truncated; pedal region ovately rounded; concentrically ridged or sulcated; ridges slightly irregular; no lunule; anal region smooth, convex in the centre; dental margin narrow, teeth few and small; margins crenulated.

Length, $\frac{1}{8}$th of an inch.

Localities. Bracklesham (*Edwards*).

France. Le Guépelle, Chéry-Chartreuve, Ver, Beauval, Houdan (*Deshayes*).

The figure was taken from a unique and perfect specimen in the cabinet of Mr. Edwards.

So far as I am able to determine from figure and description in the work above referred to, I think our little shell may be considered as identical with the Paris Basin

species. The only difference I can perceive between the English and the French fossils is in the contour of the specimens; ours being apparently a little longer and rather more rounded on the pedilateral margin. Our shell is ridged concentrically, and these ridges are rather broad, and occasionally inosculate or undulate, like those spoken of by M. Deshayes, "quelquefois un peu onduleux vers l'extremité anterieure."

A recent species from the Straits of Malacca, figured and described by Mr. Hanley under the name of *N. marmorea* ('Monog. of Nuculidæ,' p. 48, pl. v, fig. 145), appears, from representation, to be its nearest relative.

12. Nucula nudata, *S. Wood.* Tab. XX, fig. 4, *a*, *b*.

Spec. Char. N. testâ ovato-trigonâ, transversâ, tenui, valdè inæquilaterali, lævigatâ; margine dorsali vix incurvatâ, margine ventrali convexiusculâ; pedi-regione ovato-rotundatâ; lunulâ inconspicuâ; ano depresso, ovato; marginibus integris.

Shell ovately trigonal, transverse, thin, smooth, very inequilateral; dorsal margin nearly straight, ventral margin slightly curved; pedal side roundedly ovate; lunule inconspicuous; anal region depressed; margins smooth.

Length, $\frac{1}{3}$rd of an inch.

Locality. Headon Hill (*S. Wood*). Brockenhurst? (*Edwards*).

A few specimens of this species were found by myself many years ago, and I have considered them as entitled to the rank of a distinct species, in consequence of the ventral margins being quite free from denticulations, and of the outward form differing from that of any other smooth-margined species.

The shell in its contour much resembles *N. Headonensis*, but it is a little longer, more rounded, and less tumid than in that species, and it is distinguished by the difference of margin. It bears, also, some resemblance to *N. lissa*, but it differs in two or three characters; in the latter species the anal or siphonal side is more pointed or acutely angular, the dental area shorter, and the ventral margin more rounded than in *N. nudata*; in *N. lissa*, there is also a more distinct sinus or lunule below the dorsal edge on the pedal side, and the shell is comparatively longer and thinner. The angle formed by the two dental lines in this species is very little more than a right angle, but in *N. lissa* that angle is very obtuse.

13. Nucula prælonga, *Edwards*, MS. Tab. XIX, fig. 4 *a*, *b*.

Spec. Char. N. testâ elongato-ovatâ, prælongâ, lævigatâ, tenui, convexiusculâ, inæquilaterali; pedi-regione ovato-rotundatâ; siphoni-regione obliquè truncatâ; lunulâ clongato-

lanceolatâ, bisulcatâ; ano ovato, obtusè circumdato, in medio prominenti; apicibus depressis, approximatis; marginibus integris.

Shell elongately ovate, smooth, thin, and slightly convex or tumid, inequilateral; pedal region ovately rounded; siphonal region obliquely truncated, or very obtusely rostrated; lunule elongated with a central elevation or ridge; anal region ovate and centrally elevated; beaks depressed; margins smooth.

Length, 1 inch; *height*, $\frac{1}{2}$ an inch.

Localities. Barton (*Edwards*).

This species has considerable affinity with *N. bisulcata*. It appears to differ in being of a more elongated form, and in having the siphonal region more inflated; the whole shell appears to be more regularly convex, and the concentric lines or lines of growth are more distinct than they are upon *N. bisulcata*.

This shell, perhaps, was not covered with a very thick epidermis, as there are no remains of it upon any of the specimens I have seen, and the beaks are not eroded.

14. Nucula prælongata, *S. Wood.* Tab. XIX, fig. 1 *a*, *b*.

Spec. Char. N. testâ ovato-elongatâ, prælongatâ, tenui, lævigatâ, convexiusculâ, inæquilaterali; pedi-regione ovato-rotundatâ; siphoni-regione brevi, subangulatâ; lunulâ lanceolatâ, bisulcatâ; ano ovato, circumdato, in medio prominenti; apicibus depressis, approximatis; marginibus crenulatis.

Shell ovately elongate, thin, smooth, and slightly tumid, inquilateral; pedal region roundedly ovate; siphonal side short and slightly angulated; lunule elongate, with double shallow depression; corselet slightly prominent in the middle; beaks depressed; margins crenulated.

Longest diameter, 1 inch nearly.

Locality. Bracklesham (*Edwards*).

Only two or three specimens of this species have come under my observation; they somewhat resemble in form *N. prælonga*, but the crenulated margin will distinguish them, and there is a difference, also, in their comparative lengths. This shell seems, also, to be more iridescent than *N. prælonga*, and rather more deep or tumid.

Two other specimens from the same locality, in Mr. Edwards's cabinet, have a somewhat similar outline, but they have not the basal portion of the anal region quite so much extended or angular; they appear, also, to have a more distinct lunule and corselet than the one figured (*prælongata*); and these depressions (lunule and corselet) are divided by a small central ridge, which I do not perceive in our figured specimens. I am, however, unwilling to separate them, as they otherwise correspond, and future observations must determine whether they be the same or different.

15. Nucula proava, *S. Wood.* Tab. XX, fig. 3, *a*, *b*.

Spec. Char. N. testâ transversâ, ovato-oblongâ, turgidulâ, lævigatâ, valdè inæquilaterali; umbonibus minimis, terminalibus; lunulâ nullâ; ano brevi, ovato, in medio prominulo; margine dorsali convexiusculâ; margine ventrali curvatâ; dentibus ad apicem gradatim minutissimis; marginibus integris.

Shell transverse, ovately oblong, slightly tumid, smooth, and very inequilateral; beaks small, depressed, terminal; no lunule; anal region short, distinct, and slightly prominent in the centre; dorsal and ventral margins slightly curved, the latter rather the more so; teeth not very close, diminishing towards the umbo; margins smooth.

Length, $\frac{3}{4}$ths of an inch; *height*, $\frac{1}{2}$ an inch.

Locality. Near Bishopstone, Herne Bay.

A single specimen of this species is in the Museum in Jermyn Street, and the officers of that establishment have kindly permitted me to have it figured. It is the only one that I have seen.

The nearest approach to this shell that I know is *N. lævigata* of the Coralline Crag, but it differs from that species in outline; it is less curved in the ventral margin, and the anal region is shorter. In form it somewhat resembles *N. Bowerbankii*, but that species has the inner margins crenulated. The denticles are not very numerous on the pedal side; they are hidden by the matrix on the margin of the anal region; so, also, is the place for connexus.

16. Nucula protracta, *Edwards*, MS. Tab. XVIII, fig. 15.

Spec. Char. N. testâ transversâ, elongato-ovatâ, lævigatâ, tenui, tumidiusculâ, valdè inæquilaterali; pedi-regione ovato-subattenuatâ; siphoni-regioni brevi, obliquè truncatâ vel angulatâ; lunulâ parvâ, lanceolatâ, unisulcatâ; ano ovato, vix conspicuo; marginibus crenulatis.

Shell transverse, elongately oval, smooth, thin, slightly tumid, and very inequilateral; pedal region obtusely pointed; siphonal region short, obliquely truncated or angulated; lunule small, plain, elongated, and flat; corselet ill-defined; margins crenulated.

Length, $\frac{7}{8}$ths of an inch; *height*, $\frac{9}{16}$ths of an inch.

Locality. Bracklesham (*Edwards*).

A single specimen in Mr. Edwards's cabinet, from which the figure above referred to was taken, appears to be distinct, and I have, in consequence, adopted the MS. name

attached to it. The nearest approach to this in outward form is *N. sericea*, Tab. XIX, fig. 3, but that is a smaller shell, with the dorsal margin less convex and the ventral margin less curved than in this species; this shell is more ovate or less wedge-shaped, with the terminal portion of the siphoni-lateral margin more pointed, and the siphonal region slightly compressed. It resembles in outline *N. bisulcata*, but that shell has a smooth margin.

17. Nucula similis, *J. Sowerby*. Tab. XVIII, fig. 11 *a—c*.

Nucula similis. *J. Sow.* Min. Conch., t. 192, fig. 10, 1819.
— — *Morris.* Catal. Brit. Foss., p. 218, 1854.
— trigona. *J. Sow.* Min. Conch., t. 192, fig. 5, 1819.
Arca nucleus. *Solander*, in Brand. Foss. Hanton., p. 40, t. 8, fig. 101, 1766.

Spec. Char. N. testâ ovato-trigonâ, crassâ, sub-compressâ, lævigatâ aut obsoletè radiatâ, concentricè irregulariter lineatâ; siphoni-regione brevissimâ, truncatâ, ad basim eversâ, sub-acuminatâ; lunulâ anoque angulo obtuso; dentibus numerosis; marginibus crenulatis.

Shell ovately trigonal, thick, slightly compressed, smooth, or indistinctly radiated, and irregularly furrowed concentrically; siphonal region short, truncate, with the basal termination everted and somewhat pointed; lunule and corselet indistinctly defined; denticles numerous, rather thin and compressed; margin crenulated.

Length, 1 inch; *height*, ¾ths of an inch.

Locality. Barton.

Considerable difficulty exists with regard to this species, of which numerous specimens are found at Barton. It is, I believe, the true *Arca nucleus* of Solander, a specimen from his collection being still in the British Museum. *N. trigona*, Sowerby, is probably only the young, or, at most, a variety of this species; and as it is so marked upon Mr. Edwards's tablet, I am pleased to find he is of the same opinion. There is a French shell figured by M. Deshayes, *N. mixta*, 'An. sans vert. du Bassin de Par.,' t. 1, p. 819, pl. 64, figs. 1—4, which very closely resembles it; but he says the distinctions between the specimens themselves are evident and permanent, and such as will justify specific separation. Our shell is a handsome one, and is of considerable solidity, rather flat or compressed; it is readily distinguished from all other species excepting *N. mixta*. The distinguishing character is an extension or pointedness at the extreme basal portion of the siphonal region, and the hinge also is somewhat peculiar, often presenting broad teeth near the umbo.

18. Nucula sphenoides, *Edwards*, MS. Tab. XVIII, fig. 2, and Tab. XIX, fig. 2 *a*, *b*.

Spec. Char. N. testâ minutâ, irregulatim trigonâ vel sphenoideâ, tumidâ, lævissimâ, politâ; pedi-regione ovato-angulatâ; siphoni-regione brevissimâ, truncatâ; ano distincto, circumdato, in medio prominenti; lunulâ elongatâ, depressâ, divisâ; margine dorsali subarcuatâ; margine ventrali convexâ; marginibus crenulatis.

Shell small, roundedly triangular or wedge-shaped, tumid, smooth, and glossy; pedal region obtusely pointed; siphonal region very short, with a prominent anal corselet surrounded by a depression; ventral margin very convex, with the edges crenulated.

Length, $\frac{5}{10}$ths of an inch.

Localities. Hempstead, Brook? (*Edwards*).

A few specimens of an elegant little species enrich the cabinet of Mr. Edwards, and there is attached to them the above name in MS. They very closely resemble a species in the Paris Basin figured and described by M. Deshayes under the name of *N. Greppini*, especially the specimen represented by fig. 2, Tab. XIX, and when the specimens themselves are compared they may possibly prove to belong to the same species, but I have not the means of doing this. There is, however, an apparent difference, which I may here point out. Our shell has the dorsal margin less curved, while the ventral margin is more so, than is represented in the figure of *N. Greppini*, Desh., p. 882, pl. lxiv, figs. 13—16; and it has a distinct lunule or dorsal depression, divided by a slight central ridge, and it is more tumid. The anal region also has apparently a more prominent centre and deeper external depression.

19. Nucula sericea, *S. Wood*. Tab. XIX, fig. 3.

Spec. Char. N. testâ tenui, transversâ, subtrigonulâ, lævigatâ, glabrâ, calvatâ aut obsoletè radiatâ; pedi-regione productâ, angulatâ; siphoni-regione obliquè truncatâ, subattenuatâ; lunulâ inconspicuâ; margine dorsali convexiusculâ; margine ventrali arcuatâ; umbonibus acutis, terminalibus; marginibus crenulatis.

Shell thin, transverse, subtrigonular, smooth, glossy, naked, or with obsolete radiating striæ; pedal region produced and angulated; siphonal side obliquely truncated, and somewhat pointed; lunule inconspicuous; dorsal margin slightly convex, ventral margin more curved; beaks terminal; inner margins crenulated.

Length, $\frac{1}{2}$ an inch.

Localities. White Cliff, Hunting Bridge (*Edwards*).

This species somewhat resembles *prælongata* and *protracta*, but it protrudes more on the siphonal side, and the ventral margin is more rounded. It differs also in the anal

region, and it is comparatively shorter. The shell is thin, and there is no perceptible or distinct lunule on the pedal region; neither is there any distinct corselet. The specimens, which are few in number, adhere firmly to the matrix, and I am unable to see the interior.

20. Nucula subtransversa, *Nyst.?* Tab. XIX, fig. 13.

Nucula subtransversa. *Nyst.*? Coq. Foss. Belg., p. 227, pl. xviii, fig. 7, *a*, *b*, 1844.
— ovata. *Id.*? Rech. Coq. Foss. de Hoesselt et Kl. Sp., p. 13, No. 31, 1836.
— . — *Potiers* et *Mich.*? Catal. de Moll. de Douai, t. ii, p. 120, No. 3, 1844.

Spec. Char. N. testâ transversâ, oblongo-ovatâ, turgidâ, valdè inæquilaterali, obsoletè radiatâ; pedi-regione prælongâ, paulo attenuatâ; margine dorsali subrectâ; margine ventrali convexiusculâ; lunulâ inconspicuâ; ano ovato, in medio prominenti; marginibus crenulatis.

Shell transverse or elongate, ovately oblong, or obtusely wedge-shaped; very inequilateral; obsoletely radiated; pedilateral margin slightly pointed; dorsal margin nearly straight; ventral margin gently curved; corselet or anal region ovate, elevated in the middle; margins crenulated.

Length, $\frac{11}{16}$ths of an inch; *height*, $\frac{7}{16}$ths of an inch.

Locality. White Cliff Bay (*Fisher*).

The specimen figured enriches the cabinet of Mr. Fisher, who tells me it is not rare, but very difficult to obtain in any degree of perfection.

I have considered it as identical with the Belgian species, depending entirely for so doing upon figure and description, although the proportions given by M. Nyst do not quite accord with those of our own shell. This is extremely transverse or elongate—more so than any other species from the English Eocene deposits; and the umbo, which is depressed and much eroded, is at the extremity of the shell, the siphoni-lateral margin forming almost a right angle with the dorsal edge. The outer surface shows distinct but irregular lines of increase, and the nearly obsolete rays upon the specimen are most visible towards the pedilateral margin, as they are described to exist on the Belgian shell.

M. Nyst points out a distinction which exists between his shell and the one which he considers to be the same from the Paris Basin in the number of the hinge-teeth. Unfortunately I am unable to ascertain the dental characters of our shell.

21. Nucula Thanatiana, *Edwards*, MS. Tab. XIX, fig. 6.

Spec. Char. N. testâ ovato-trigonâ, convexiusculâ, tenui, valdè inæquilaterali, radiatim striatâ; striis tenuibus, sub-decussatis; lunulâ nullâ aut indistinctâ; ano plano, lævigato; cardine crassiusculo, umbonibus minimis; marginibus dorsali et ventrali convexiusculis; margine ventrali crenulatâ.

Shell ovately triangular, rather convex or tumid, thin, very inequilateral, and covered with radiating striæ; striæ fine and irregularly decussated; no distinct lunule; siphonal or anal region flattish and smooth; hinge rather thick, umbones small; dorsal and ventral margins slightly and nearly equally convex; margins crenulated.

Length, $\frac{1}{2}$ an inch.

Locality. Pegwell Bay (*Edwards*).

The figure above referred to was taken from an unique specimen in Mr. Edwards's cabinet, of which the umbo was not quite perfect; it represents the shell as rather more elongated than it ought to be.

22. Nucula tumescens, *Edwards*, MS. Tab. XVIII, fig. 1 *a—c*.

Spec. Char. N. testâ ovato-trigonulâ, tumescenti, crassiusculâ, lævigatâ, obsoletè radiatâ; pedi-regione sub-cuneatâ; siphoni-regione brevissimâ, truncatâ; umbonibus terminalibus, depressis; lunulâ indistinctâ; marginibus crenulatis; dentibus numerosis, ad apicem decrescentibus.

Shell ovately triangular and wedge-shaped, tumid, rather thick, and smooth; pedal region obtusely wedge-shaped; siphonal region very short; exterior obsoletely rayed; beaks terminal, depressed; lunule indistinct; anal region marked with an obtuse elevation or ridge; margins crenulated; teeth numerous, decreasing towards the umbo.

Length, $\frac{1}{2}$ an inch; *height*, $\frac{5}{10}$ths of an inch.

Localities. Mead End, Barton (*Edwards*).

This is not rare. The principal distinction of the species is its great tumidity, thereby giving more than ordinary depth to the interior of the umbonal region.

23. Nucula Wetherellii, *J. Sowerby*. Tab. XIX, fig. 9 *a*, *b*.

Nucula Wetherellii.	*J. Sow.*	Geol. Trans., 2nd ser., vol. v, pl. viii, fig. 12, 1834.
—	—	*Prestwich.* Geol. Journ., 1847, p. 405.
—	—	*Morris.* Catal. Brit. Foss., p. 218, 1854.

Spec. Char. N. testâ ovatâ, vix elongatâ, gibbosâ, lævigatâ, subinæquilaterali; pedi-regione rotundatâ; siphoni-regione obliquè truncatâ vel obtusè rostratâ; umbonibus depressis; marginibus crenulatis.

"Shell suborbicular, transverse, gibbose, smooth; extremities pointed; beaks nearly central, margin obtuse, edge toothed."—*J. Sowerby.*

Length, $\frac{1}{2}$ an inch.

Locality. Hampstead Heath (*Wetherell*); Highgate, Sheppy? (*Edwards*).

"The radiating structure of this Nucula, common to the species of the genus, is very conspicuous, but the inner surface is not striated, as in *N. Bowerbankii*."—*J. Sowerby.*

The specimens of this species that I have seen are not numerous, and, unfortunately, they are not in perfect condition; the umbones are excessively eroded, thereby reducing their natural proportions, giving a slightly rounded outline to the shell.

Since the type for the preceding descriptions has been set up, several specimens belonging to this genus have come under my inspection, which I cannot assign to any of the foregoing species; and although they do not present characters sufficiently determinable for specific isolation and description, they are, I conceive, fully deserving of representation and notice, and I propose here to give to them provisional names only until they can hereafter, by the possession of more specimens, be satisfactorily characterised.

Tab. XX, fig. 10, represents the interior cast of a shell from Clewer Green, near Basingstoke, kindly lent to me by Mr. Prestwich, and to which I will give the name of *N. venusta;* it appears to have possessed a smooth margin to the edge of the valves, and it has a very slight basal projection on the siphonal side; there is a prominence in the anal region, and in its contour it is intermediate between *N. bisulcata* and *N. prælonga*, but to neither of those smooth-margined species can it, I think, be referred. The age of the deposit in which it is found being greater than that of the two other species strengthens the supposition that this is distinct.

Tab. XX, fig. 7, is the representation of a specimen, also from Mr. Prestwich's cabinet, to which the locality Cuffells is attached; this appears to be different from any of the foregoing, but it is imbedded in the matrix, and I am unable to describe its true characters. I give it the name of *N. consobrina;* in outline it somewhat resembles *N. consors*, from Highgate, but is, I think, too long and too much truncated for that species; it has a very slight elevation in the anal region, but there is no perceptible lunule, although there is a slight depression on the dorsal surface extending from the umbo to the verge of the pedal extremity; the shell is thick, nacreous within, and the denticles are large, twenty-four on the pedal side, and seven or eight on the other.

Tab. XX, fig. 6, represents a specimen very recently obtained from the Woolwich series at Bickley, by Chas. A. Meyer, Esq.; this shell has been kindly submitted to my examination. It is probably distinct, and I will call it for the present *N. gracilenta;* its nearest relative appears to be *N. fragilis*, but on a comparison with specimens of that

species in the British Museum, it presents the following differences:—*N. fragilis* has the basal margin on the anal side more pointed, with the centre of the anal region more elevated and distinct, and the pedilateral margin is not quite so much rounded: there appears also to be a difference in the number of denticles, but a larger number of specimens will be required to determine its correct position.

Tab. XX, fig. 9, is a shell recently obtained by Mr. Gibbs from the Basement-bed of the London Clay at Herne Bay, and the officers of the Museum in Jermyn Street, to which it belongs, have kindly permitted me to have it figured. I am unable to refer it to any known species, and propose to give to it the name of *N. striatella*. It appears to be specially distinguished by an unusually prominent anal region; it is finely rayed, and the margins are denticulated.

Tab. XX, fig. 8 *a*, represents a specimen also from the Thanet Sands at Herne Bay. This I at first thought to be probably the perfect condition of *N. cardioides*, which the young or unmutilated portion of that shell somewhat resembles; but upon close comparison the two specimens do not satisfactorily accord. Mr. Edwards has given to this specimen the MS. name of *sextans*, the outline of it forming somewhat irregularly the sixth part of the circle. Fig. 8 *b*, of the same plate is the likeness of a shell in Jermyn Street, from Herne Bay, which may probably belong to the same species, coming, as it does, from the same bed; but I have had it represented in consequence of a difference in outline, it being less triangular than fig. 8 *a*, the dorsal margin on the pedal side being more convex, and the pedilateral margin less pointed. The anal region (which, I think, in general affords a good auxiliary character) is, unfortunately, in this specimen broken.

The recent discovery of these last-noticed specimens has caused considerable delay in the preparation of my work, but they appear of so much interest and of so much importance towards a history of the contents of our Eocene deposits, that I thought it would not be pardonable to pass them over, and now, at the eleventh hour, another shell has come into the possession of Mr. Edwards, which appears to me to be also worthy of especial notice, and I have had it figured.

Tab. XIX, fig. 21.—This last specimen is a very elegant shell; it approaches in form very closely to *N. lævigata* of the Crag, and I have given to it the name *N. prælævigata*, in consequence of its very near relationship. It is excessively thin, quite smooth externally, and it has a margin free from crenulations; it differs from *N. proava* in being thinner, and in having the anal region shorter than in that species; and it differs from *N. lævigata* in having a depression or shallow sulcus on the dorsal region beneath the dental edge; the curvature of the ventral margin, although nearly as great as in the Crag shell, is not quite so regular, and the pedilateral margin being a little broader in our present specimen, will distinguish it. The interior I have not been able to examine. The shell is too thin and too firmly imbedded in the matrix to permit of removal.

LEDA. *Schumacher*, 1817.

Generic Character. Shell equivalve, inequilateral, elongate, lanceolate, or elliptical, sometimes fig-shaped, rounded at the pedilateral margin; siphonal region more or less pointed or rostrated; umbones small, approximate; hinge with numerous sharp, generally angular, and interlocking teeth, separated by a spoon-shaped or triangular fossette; connexus cartilaginous; palleal line sinuated, with a linear impression, more or less distinguished, extending from the middle of the umbonal region to the base of the oral adductor muscle-mark. In the recent state the shell is covered by a thick epidermis.

Animal with the mantle open in front, margins simple, sometimes fimbriated; foot large, discoidal, with serrated edges; siphons slender, unequal, partially united.

This genus is distinguished from *Nucula* by the prolongation or extension of the siphonal region making some of the species equilateral, or even reversing the comparative dimensions, giving the smaller and shorter portion to the pedal side. Möller has subdivided this genus, and proposed the name of *Yoldia* for those shells which gape on each side. These two names are still adopted by some authors, who maintain the distinction to be sufficient for generic division. Mörsch has made another division for those which are closed at both extremities, and for which he proposes the generic name of *Portlandia*, while *Leda* proper is said to gape only on one side. The distinctions here spoken of are, I fear, very unstable, and will probably, by the greater number of conchologists, be considered only of specific value. *Solinella* has a similarly shaped shell, with the dental area furnished with a row of small, sharp, angular teeth on each side of the umbo similar to those of the present genus; but the connector there is wholly ligamental, situate externally upon a projection or fulcrum, and this character fairly entitles the shell in question to generic distinction.

The shells of this genus (*Leda*) are often quite smooth; but some have concentric ridges or thickened lines of growth, and a few are ornamented with ridges in an oblique direction, the inner margins of the shells are at all times free from crenulations.

Species of this genus in the recent state have been found in all parts of the world and in all climates, and at all depths: upwards of seventy have been described; and in the 'Proc. of the Nat. Hist. Soc. of Philadelphia,' 1860, p. 49, Mr. Binney called attention to a species of *Leda* which Dr. Gould says is common to the seas of Japan and to the coast of Massachusetts.

In the fossil state they are also numerous, and have been found low in the Secondary formations.

1. Leda amygdaloides, *J. Sowerby*. Tab. XVII, fig. 6, *a—c*.

Nucula amygdaloides. *J. Sow.* Min. Conch., t. 554, fig. 4, 1821.
— — *Wetherell.* Tr. Geol. Soc., 1834, p. 134.
— — *Morris.* Catal. Brit. Foss., p. 217, 1854.

Spec. Char. L. testâ elongato-ovatâ, crassâ, tumidâ, sub-æquilaterali; concentricè striatâ, striis obtusis rotundis; pedi-regione ovato-rotundatâ; siphoni-regione obtusè rostratâ; areâ dentali crassiusculâ; fossulâ connexûs minutâ, profundâ.

Shell elongately ovate, thick, tumid, glossy, nearly equilateral, and concentrically striated; striæ rounded; pedilateral margin ovately rounded; siphonal region obtusely pointed; dental area rather thick; cartilaginous depression small.

Length, 1 inch; *height* $\frac{1}{2}$ an inch.

Localities. Highgate, Potter's Bar, Wandsworth, Sheppey, Hampstead, Southend, Whetstone Park, Finchley, Hornsey (*Edwards* and *Wetherell*), Cuffells (*Prestwich*).

This is an elegant shell, and abundant in some localities, but seldom found with the valves separated. Casts of this shell (at least what appear to be so) are found at Sheppey. The nearest approach to this species is *N. Deshayesiana*, Nyst ('Coq. Foss. Belg.,' p. 221, pl. xv, fig. 8); but that shell differs in being larger, thicker, with a more inflated and more prominent umbo; the striæ in the British shell extend to the extreme margins, and cover the entire surface, as they do also in *N. Deshayesiana*. There is a distinctly marked corselet as well as lunule on each side of the umbo, with an elevated ridge; this is not so distinctly marked in the Belgian shell, and the siphonal region of this latter species is rather the more pointed of the two. There are about fifteen or sixteen denticles on each side of the hinge-area of our shell, and the sinus in the mantle-mark is very shallow.

2. Leda costulata; *Deshayes*. Tab. XVIII, fig. 3, *a*, *b*.

Leda costulata. *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 829, pl. 65, figs. 8—10, 1858.

Spec. Char. L. "*testâ ovato-transversâ, subtrigonâ, solidulâ, depressiusculâ, æquilaterali, anticè obtusâ, posticè vix rostratâ, transversim regulariter sulcatâ; umbonibus minimis, conniventibus; lunulâ lævigatâ, vix distinctâ; ano elongato, lanceolato, convexiusculo, angulo obtuso separato; margine cardinali angusto; dentibus serialibus minutissimis, approximatis; fossulâ ligamenti minutissimâ.*"—*Desh.*

Shell elongate, ovately subtrigonular, strong, somewhat depressed, equilateral; pedilateral margin ovately rounded; siphonal region scarcely rostrated, covered concentrically with broad ridges and furrows; beaks small; lunule indistinct; corselet elongate, slightly convex, ex-

tending the length of the siphonal region; hinge-area narrow, with a small pit for the connector.

Length, $\frac{1}{4}$ inch; *height*, $\frac{3}{10}$ths of an inch.

Locality. Bracklesham (*Edwards*).

A single specimen is in the cabinet of Mr. Edwards; it is the only one I have seen, and, judging from the figure and copious description given by M. Deshayes, I feel no hesitation in referring it to this elegant species. I agree fully in opinion with M. Deshayes that it is quite distinct from *Leda striata* of the Paris Basin, and it is still further removed from what has been called *Leda striata* from our own deposits.

The siphonilateral margin of our shell is more rounded and less pointed than that of *L. striata*, and it corresponds in that character both with *L. oblata* and *L. amygdaloides*; but it differs from the former in being *entirely* covered with ridges, and in being also more equilateral; and from the young of the latter in having the ridges much larger and more distant, and in being comparatively shorter. The dental margin is very narrow, and is furnished with about a dozen denticles on each side of the cartilaginous pit, which is also comparatively small; the shell is thin, and the muscle-mark on the siphonal side is large; the external ridges are visible in the interior. Shell nacreous.

3. Leda Galeottiana, *Nyst*. Tab. XVII, fig. 2, *a*, *b*.

Nucula mucronata. *Galeotti*. Mém. Const. Géol. Prov. de Brabant, p. 155, No. 123, 1837.
— — *Nyst*. Coq. Foss. de Belg., p. 223, pl. 18, fig. 3, 1844.
— serrata. *J. Sow*. in Dixon's Geol. of Sussex, pp. 93, 170, pl. 2, fig. 9, 1850.
Leda Galeottiana. *D'Orb*. Prod. de Paléont., t. ii, p. 378, No. 808, 1850.
— — *Desh*. An. sans Vert. du Bass. de Par., t. i, p. 830, pl. 66, figs. 1—3, 1858.
— serrata. *Morris*. Catal. Brit. Foss., p. 206, 1854.

Spec. Char. L. testâ minimâ, depressâ, ovato-lanceolatâ, subæquilaterali, pedi-regione ovato-rotundatâ, siphoni-regione rostrato-acuminatâ; concentricè striatâ vel costatâ; striis paucis, magnis, elevatis; lunulâ lanceolatâ paulo excavatâ; ano magno, bipartito; umbonibus depressis; marginibus integris.

Shell small, depressed, elongately ovate, nearly equilateral; pedal region ovately rounded; siphonal region angularly pointed; covered with a small number of elevated ridges or lines of growth; lunule elongated and somewhat shallow; beaks depressed, margins smooth.

Length, $\frac{1}{4}$ inch; *height*, $\frac{1}{8}$th inch.

Locality. Bracklesham (*Edwards*).

France: Damery, Montmirel, Courtagnon (*Desh.*).

Belgium: Les sables de Laecken, de Jette, de Forêt, et de Louvain (*Nyst*).

This elegant little shell appears to be rare. The ridges on the exterior are elevated, distinct, and large, with deep furrows between them; the furrows are nearly as broad as the ridges. On the siphonal region there is a distinct and elevated keel, sloping from the umbo to the extremity of the siphoni-lateral margin.

4. Leda minima, *J. Sowerby*. Tab. XVII, fig. 7, *a—e*.

Nucula minima. *J. Sow.* Min. Conch., t. 192, fig. 8, 1818.

Spec. Char. L. testâ minimâ, ovato-lanceolatâ, elongatâ, tumidâ, subæquilaterali, concentricè striatâ striis numerosis prominentibus; pedi-regione rotundatâ; siphoni-regione rostratâ, sub-acuminatâ; umbonibus minimis, approximatis; ano magno, lanceolato, angulo mediano bipartito, angulo obtusiore conscripto; cardine crassiusculo, multidentato; fossulâ minimâ, profundâ.

Shell small, elongately ovate, tumid, nearly equilateral; pedal region rounded, siphoni-lateral pointed; beaks small, approximate, covered with concentric striæ or ridges; corselet distinct, elevated in the centre; dental margin thick, with numerous teeth; cartilaginous support small and deep.

Length, $\frac{1}{4}$ of an inch; *height*, $\frac{1}{7}$th of an inch.

Locality. Barton, Bracklesham, Bramshaw, Brook, Highcliff (*Edwards*).

There are three or four species of this genus about the same magnitude, possessing many similar characters, which have been found in the British Eocene deposits, and it is somewhat difficult to say which was the one intended by Mr. Sowerby for *N. minima*. The present one is abundant, and probably was the one his figure is designed to represent. He says, "Transversely ovate, convex, transversely striated." The striæ in this species cover the entire surface; they are fine and rounded, extending from the pedilateral margin to the angular ridge on the slope of the siphonal region, beyond which is a large corselet; this is of a lanceolate form, divided by a central ridge, the upper portion of which is finely striated. There is a row of angular teeth (at least a dozen) on each side of the cartilage-pit.

There are two varieties of this shell, one of which strongly resembles the figure of *L. gracilis*, Desh. ('An. sans Vert. du Bas. de Par.,' p. 831, pl. 64, figs. 24—26); and several differences are presented, as might be supposed, among our numerous specimens; some have the pedal region almost smooth, as if from abrasion on that part, which is generally buried by the animal in the living state.

5. Leda oblata, *S. Wood.* Tab. XIX, fig. 10.

Spec. Char. L. testâ minimâ, elongato-ovatâ, oblatâ, lævissimâ, glabrâ, subæquilaterali; pedi-regione tumidâ; siphone-regione compressiusculâ, margine obtusè rostratâ; umbonibus prominulis.

Shell small, elongately ovate, externally smooth and glossy, slightly inequilateral; pedal region tumid and rounded; siphonal region compressed; obtusely rostrated; beaks slightly prominent.

Length, $\frac{1}{3}$rd of an inch.

Localities. Chalk Farm (*Wetherell*), Potter's Bar (*Edwards*).

There are a few specimens in Mr. Wetherell's cabinet, and also in Mr. Edwards's, which very much resemble, in outline and general characters, *L. partim-striata* from Highgate and Clarendon; but they differ in having the exterior perfectly smooth and glossy, and appear to be quite free from the ridges which ornament the centre or ventral portion of the shell of that species. This species presents some resemblance to the variety *L. prisca*, from Highgate; but the shell is larger, and the siphoni-lateral margin is not so pointed. The specimens are too closely imbedded in the clay to permit of removal, and the interior is consequently invisible.

6. Leda prisca *Deshayes.* Tab. XVII, fig. 4, *a—d.*

Leda prisca. *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 830, pl. 65, figs. 15—17.

Spec. Char. L. "testâ minimâ, obovatâ, tumidâ, lævigatâ, politâ, striis incrementi vix conspicuis; anticè rotundatâ; posticè angulatâ, acutâ, cuneatâ; umbonibus submedianis, depressis; lunulâ ellipticâ; dentibus 8—9 *utroque angulatis; marginibus integris."*

Shell small, obovate, tumid, or inflated; smooth, glossy, with scarcely visible lines of growth; one side rounded and the other angulated and sharp or wedge-shaped; umbones subcentral, depressed; lunule elliptical; denticles about 8—9 on each side; margins smooth.

Length, $\frac{3}{16}$ths of an inch; *height*, $\frac{1}{10}$th of an inch.

Localities. Var. *α*, Highgate (*Wetherell*); var. *β*, Barton (*Edwards* and *S. Wood*).

This pretty little shell is by no means abundant. It strongly resembles *L. pygmæa*, the existing British and Mediterranean species.

There are two British Eocene shells that I think may be assigned to the French species; they differ a little in the number of denticles; the one from Highgate corresponds closely with the description given by M. Deshayes; the other, from Barton, does not appear to have quite so many teeth in the hinge-line. They both differ from

L. pygmaea in being rather more pointed or angulated at the siphoni-lateral margin, with a less elevated umbo, and there is a rather large cartilaginous area and a narrower hinge, the shell also is more tumid.

The Highgate variety of *L. prisca* is most probably *N. minima* of 'Min. Conch.,' t. 192, fig. 9, which Mr. Sowerby suspected might be the cast of another species.

7. Leda partim-striata, *S. Wood.* Tab. XVII, fig. 1, *a—c.*

Nucula striata, var. J. Sowerby. Trans. Geol. Soc., 2nd ser., vol. v, pl. viii, fig. 12, 1834.

Spec. Char. L. testâ elongato-ovatâ, oblatâ, tumidâ, tenui, subæquilaterali; pedi-regione convexâ, siphoni-regione longiore et obtusè rostratâ; in medio longitudinaliter costatâ vel sulcatâ; utrinque lævigatâ; umbonibus prominulis.

Shell elongately ovate, oblate, tumid, thin, inequilateral; pedal region convex; siphonal region the longer, laterally compressed, and obtusely rostrated; central region longitudinally ridged, with both extremities smooth; beaks slightly prominent.

Length, $\frac{1}{3}$rd of an inch.

Localities. Clarendon, Highgate, Potter's Bar, Haverstock Hill, Alum Bay (*Edwards*), Hampstead Heath (*Wetherell*).

Although this species appears to have had an extensive geographical range, it is nowhere found in abundance.

The species to which it approaches nearest is *N. amygdaloides*, Sow., from which, however, it differs in being only partially covered with ridges, and it is also more inflated and more obtuse. The ventral region is covered with ridges, but the pedal, as also the siphonal sides, are quite smooth. The shell is tumid only in the pedal and central regions; and compressed on the siphonal side.

8. Leda propinqua, *S. Wood.* Tab. XX, fig. 2.

Spec. Char. L. testâ minutâ, ovato-subtrigonulâ, convexiusculâ, sub-inæquilaterali, tenui, lævigatâ; pedi-regione elongato-ovatâ vel semi-ellipticâ; siphoni-regione subrostratâ et angulatâ; umbonibus depressis, utrinquè sub-æqualiter declivis, lunulâ unoque vix perspicuis.

Shell small, ovately triangular, slightly convex, nearly equilateral, thin, and smooth; pedal side elongately ovate or semi-elliptical; siphonal side obtusely rostrated or dorsally angulated; beaks depressed, with nearly an equal slope on each side; lunule and corselet scarcely perceptible.

Length, $\frac{5}{16}$ths of an inch; *height*, half the length.

Locality. Colwell Bay (*Edwards*).

A single specimen from the above locality is in Mr. Edwards's cabinet, and this I am unable satisfactorily to assign to any other species. I therefore give it the above name provisionally. The species this shell most nearly resembles is *L. oblata*, from Highgate, but the present shell is thinner and flatter; it is also comparatively longer, and the siphoni-lateral margin is more pointed. Our shell appears to be quite smooth upon the exterior, and glossy; the dorsal margin on the pedal side is slightly convex; on the siphonal side it is nearly straight. The specimen is firmly imbedded in the matrix.

9. Leda substriata, *Morris*. Tab. XVII, fig. 5.

Leda substriata. Morris. Geol. Journ., vol. viii, p. 266, pl. 16, fig. 7, 1852.

Spec. Char. L. testâ minimâ, ovato-elongatâ, subtrigonâ, tumidiusculâ, sub-inæquilaterali, concentricè striatâ aut obtusè costatâ; pedi-regione ovato-rotundatâ; siphoni-regione longiore, subrostratâ et sublævigatâ; umbonibus prominulis; lunulâ vix distinctâ; ano elongato, lanceolato.

Shell small, ovately elongate, obtusely trigonular, rather tumid, slightly inequilateral; concentrically striated or obtusely ridged; pedilateral margin ovately rounded; siphoni-lateral obtusely pointed; beaks prominent; lunule ill defined.

Length, $\frac{3}{8}$ths of an inch; *height*, $\frac{1}{4}$ of an inch nearly.

Locality. Richborough (*Prestwich*), Pegwell Bay (*Edwards*).

"This shell, collected by Mr. Prestwich from the Thanet sands at Richborough, Castle and Pegwell Bay, is difficult to distinguish from *Nucula striata*, Lam., which it resembles in general form, but is rather longer in a transverse direction, and the striæ differ a little, and are interrupted towards the posterior margin in some of the specimens examined."—*Morris.*

In addition to the above remarks I may observe, that the French shell has different proportions: the siphonal region is rather less than the pedal, whereas in the British shell it is the reverse. This species appears still more to differ from *Leda minima*, which has a distinct and well-marked anal or corselet region, with a defined and prominent ridge, and the siphoni-lateral margin is in that shell more pointed than in either our present species or the French shell *L. striata*.

UNIO. *Phillippson*, 1788.

Generic Character. Shell equivalve, inequilateral, generally thick and externally smooth, occasionally corrugated or ornamented with nodules or spines; aged specimens sometimes become ponderous. Covered by an epidermis in the living state; eroded at the umbones; hinge with two short cardinal teeth in the left valve, and one, sometimes two, in the right, and one elongated lateral tooth beneath the dorsal margin. Impressions

by the adductors large and deep; pedal muscle-marks distinct—one double, situate near and below the oral, the other single, and above the anal adductor; mantle-mark without a sinus; shell nacreous; connexus ligamental.

Animal with the margins of the mantle disunited, except between the siphonal openings; tubes short—one fringed, the other plain; foot compressed.

Variations in the fresh-water mussels are numerous and excessive, and many genera, with very ill-defined lines of distinction, have been proposed for their reception. Unios are of a peculiar construction, being formed almost entirely of nacre; and some of the recent species not only display a beautiful pearly lustre, but are of a purple, pink, or salmon colour in the interior. Colour, Mr. Lea says, is not always to be depended upon for a specific distinction.

This genus is found in the Wealden formation, and is said to have been in existence during the Carboniferous period.

Mr. Lea, who is our best authority on this subject, says of this genus that there are already described, as inhabiting the rivers, lakes, and pools of the United States and Territories, 465 species, to which several more in his own cabinet will have to be added; and he considers that there are upwards of 600 species belonging to the family Unionidæ that are peculiar to North America. This large number is, perhaps, the more extraordinary when compared with the number of existing species on our own continent. Mr. Lea further says ('Proc. Acad. Nat. Sc. Philad.,' p. 3, 1860), that he had taken great pains to procure specimens from all parts of Europe, "and he was satisfied that there were ninety-eight synonyms made by European authors for the single species *Anodonta cygnea*, Drap. (*Mytilus cygneus*, Linn.), and that the synonomy is nearly as profusely erroneous in *Unio pictorum*, *Unio tumidus*, *Unio Batavus*, and *Unio littoralis*." The number of recent species he has allotted to Europe is seven *Uniones*, one *Margaritacea*, one *Monocondylea*, and one *Anodonta*. This great discrepancy between the numbers on the two continents gives to North America a preponderance of sixty-fold over those of Europe. The extent of fresh water in the rivers and lakes of America may in some degree be assigned as a cause for the very great development of species in that continent over those in Europe; but that alone appears insufficient for explanation, as the proportions of fresh water between the two continents will not bear a comparison with this disproportion of species, more especially when we consider that it is principally on the shores of these extensive lakes, or at least in not very deep water, that we are likely to find living many of the species, and can hardly take into our computations the fresh-water area of North America. This would materially reduce the apparent excess in the area of feeding-ground for these animals in America over that in Europe, and it does appear to me that some other cause than mere difference in the superficial extent of the medium in which they live, is required to account for this great difference in the relative number of the species found in the two Continents. We have, according to Mr Lea, ninety-eight synonyms in a single European species, thereby implying very great variation; but to what extent we are permitted to

carry our opinions respecting what amounts to simple variation and what constitutes specific distinction will probably long be matter for dispute. The differences in America, considered sufficient for specific isolation according to this author, appear to be more clearly defined than they are with us. We have nothing in other sections of the Mollusca, either marine or terrestrial, that will bear a comparison with such an enormous difference in the number of species as is alleged to be exhibited in this family, and if correct (and I am not able to say that it is otherwise) it is an anomaly in the history of the Mollusca.

The remains of fresh-water deposits of any past period give comparatively a very limited number of species in this family, bearing in that respect a resemblance to the dissemination of these animals on the continent of Europe. I have here figured seven species from the Eocene deposits of England, but these are not at all well defined; and there are nine or ten in those of France. The Upper Tertiary species are, I believe, still existing. We might, perhaps, expect that the limited number of living species should have descended from a limited number of their predecessors; but the fresh-water Tertiary deposits of America appear also to have been but sparingly supplied by these animals, while the specific development in this family at the present day in America is out of all proportion when the present is compared with the past, as is here attempted to be done with the Tertiaries of Europe and their descendants.

M. Deshayes considers one of the French Eocene shells *U. Michaudi*, to be very closely related, probably the same, as a living species in North America, *U. cicatricosus;* but I have not been able to identify any one of our own. This may arise from a want of acquaintance with the numerous existing species of the American waters, where almost every conceivable form of the genus is represented. On a comparison with the figures and descriptions of the existing shells, given by Mr. Lea, there may be pointed out two or three which very closely resemble those of British Eocene species; and when each comes to be better known, and the specimens themselves compared, it is possible that one or more may be found to have retired from England in the direction of America after the Eocene period, through land, or rather rivers, that probably existed at that time on the western side of the Eocene sea of Europe, such as has been the case with peculiar genera of fresh-water fish and reptiles now confined to the American continent. Our own fossils in this genus, from the older Tertiaries, are generally far from being in a perfect state of preservation, so that no fair comparison can be made or relied upon. The specific separations here proposed must for the present be considered merely as provisional; for with the fate of an existing European species before our eyes, with its ninety-eight synonyms, it would be hazardous in the extreme to pronounce decisively upon the few and in most instances imperfect specimens hitherto obtained from our Eocene deposits.

1. Unio Austenii, *Forbes*, MS., and *Morris*. Tab. XX, fig. 12.

Unio Austenii. *Morris*. Mem. Geol. Surv., p. 147, pl. 2, fig. 7, 1856.

Spec. Char. "*Testâ oblongâ, ovali, modioliformi, posticè obtusè rotundatâ; margine dorsali leviter arcuato; margine ventrali subrecto; umbonibus ferè terminalibus.*

"An oblong, depressed, modioliform shell, somewhat expanded, and rounded posteriorly; the umbones are depressed and nearly terminal; the surface is but obscurely striated."—*Morris*.

Locality. Hempstead.

The only specimen that I have seen is the one which enriches the Museum in Jermyn Street, and on which the species has been established. The principal character of distinction appears to me to be its inequilaterality, which is in excess.

2. Unio Edwardsii, *S. Wood*. Tab. XX, fig. 16, *a*, *b*.

Spec. Char. U. testâ elongato-ovatâ aut elongato-cuneatâ, crassâ, irregulariter et concentricè sulcatâ vel corrugatâ, inæquilaterali, convexiusculâ; pedi-regione obtusè rotundatâ; siphoni-regione valdè longiore et obtusè acuminatâ; margine ventrali subcurvato.

Shell elongately ovate or wedge-shaped, thick, and irregularly ridged by lines of growth, slightly convex or tumid; pedilateral margin obtusely rounded; siphonal region much the longer and roundedly pointed; ventral margin slightly curved.

Length, $2\frac{1}{4}$ inches; *height*, $1\frac{1}{4}$ inch.

Locality. Peckham (*Edwards*).

Specimens of this species are few and imperfect, but the form is peculiar, differing from that of any other Eocene species; it much resembles *U. pictorum*, but it is not sufficiently pointed on the siphonal side, and it is more inequilateral. One of our figures represents a specimen that has lost nearly the whole of the shell, but it gives a very good representation of the outward form; and the other figure shows the exterior to have been more than usually rugged or corrugated, from which circumstance the specimens have had attached to them in Mr. Edwards's cabinet the MS. name of *corrugata*, which I should have adopted, had it not been employed for a recent species in America. I therefore propose for our shell the name of the Author of the 'Monograph on the Eocene Mollusca.'

3. Unio Gibbsii, *Forbes*, MS., and *Morris*. Tab. XX, fig. 14.

Unio Gibbsii. *Morris*. Mem. Geol. Survey, p. 147, pl. 2, fig. 6, 1836.

Spec. Char. "*Testâ elongato-ovatâ, transversâ, utráque extremitate obtusâ, sed posticè obscurè angulatâ; margine ventrali subrecto.*

" An ovate, elongate, or somewhat quadrate shell, with the anterior extremity rather more rounded than the posterior, which is slightly angulated and truncated.

" The specimen figured has undergone some compression, which has partially modified the original form. It was considered, and therefore figured, as a distinct species by Professor E. Forbes; it is, however, closely allied to and difficult to distinguish from some varieties of *U. Solandri*."—*Morris*.

Locality. Hempstead Cliff.

I am much inclined to think, with Professor Morris, that it is only a variety (and that not a very distinct one) of *U. Solandri*.

4. Unio Solandri, *J. Sowerby*. Tab. XX, fig. 11, *a*, *b*.

Unio Solandri.	*J. Sow.*	Min. Conch., t. 517.
—	—	*S. Wood.* Catal. in Lond. Geol. Journ., p. 118. 1847.
—	—	*Wright.* Ann. and Mag. Nat. Hist., June, 1851, p. 6.
—	—	*Morris.* Catal. Brit. Foss., p. 230, 1854.

Spec. Char. U. testâ transversâ, oblongâ vel subrhomboidali, compressâ valdè inæquilaterali; pedi-regione rotundatâ, siphoni-regione truncatâ; valvis tenuibus; umbonibus vix prominentibus; dente cardinali parvo, laterali elongato; striis crescentibus exilissimis.

Shell tranversely ovate, oblong, and slightly compressed, very inequilateral; pedilateral margin rounded, the opposite one somewhat angularly truncated; valves thin; umbones depressed; cardinal hinge-tooth small, with an elongated lateral tooth; connexus short; lines of increase very fine.

Length, 1¾ inch, *breadth*, ⅞ths inch.

Localities. Hordwell, Colwell Bay.

Although so common as this shell is at Hordwell, it does not appear to have been known to Solander, at least he does not figure it.

The shell called *Mya pictorum*, Foss. Hant. fig. 95, referred to in 'Min. Conch.,' vol. vi, p. 29, with a ?, is probably *Cytherea lævigata*. The shells at Hordwell are in great profusion, but they are exceedingly fragile, and generally exfoliated, so that it is very difficult to obtain a perfect specimen. The proportions in magnitude of this shell are generally about two in length to one in height, and rather more than half a one in thickness or tumidity. The dorsal and ventral margins are nearly parallel, or with a very slight curve inwards in the ventral margin, and the siphonal is three times the length of the pedal region. In the right valve there is one rather prominent tooth a little on the pedal side of the umbo, and this is obsolete in the left valve; the elongated lateral tooth is the reverse of this, being prominent in the left valve and obsolete in the right. The oral muscle-mark is of a moderate

size, deeply impressed, and there is a distinct pedal one within and a little below it; the anal one large and remote; the umbones are rugose, and generally eroded. The epidermis is visible on well-preserved specimens, which have also the connector entire, extending from the umbo about half the length of the shell.

A large portion of the stratum in which these shells abound at Hordwell is a marly bed, but I obtained a few perfect specimens from a pure siliceous sand.

5. Unio subparallela, *Edwards*, MS. Tab. XX, fig. 13, *a*, *b*.

Unio Deshayesii? *Prestwich*. Quart. Journ. Geol. Soc., 1854, p. 118.

Spec. Char. *U. testâ elongatâ, sub-quadrangulatâ vel ovato-oblongâ, lævigatâ, depressâ, valdè inæquilaterali; pedi-regione brevi, rotundatâ; siphoni-regione longiore, subangulatâ vel obliquè truncatâ; umbonibus depressis; marginibus ventrali et dorsali subparallelis.*

Shell transversely elongate, or ovately oblong, smooth, depressed, very inequilateral; pedilateral margin rounded; siphonal region much the larger, slightly angulated or obliquely trunculated; umbones depressed; dorsal and ventral margins nearly parallel; ventral margin slightly incurved.

Length, $2\frac{1}{4}$ inches; *height*, $\frac{13}{16}$ths of an inch.

Localities. Peckham (*Edwards*), Counter Hill, Deptford (*Prestwich*).

The specimen referred to *U. Deshayesii* by Mr. Prestwich most probably belongs to the same species as the one here figured, but "its mutilated condition would not permit of determination."

In comparing our present species with the *U. Wateleti* (olim *U. Deshayesii*), the differences appear too great to permit of their being united, and I have therefore adopted the MS. name that was attached to Mr. Edwards's specimen.

I am the more disposed to this separation, because I have not only the figures and description of the French shell in the valuable work by M. Deshayes, but there is also a specimen in the cabinet of Mr. Edwards, sent from France by the author of the species.

A shell from the "Terrain de lignite" in the South of France has been figured and described by M. Matheron under the name of *Unio galloprovincialis*; 'Cat. meth. et descr. des corps organ. foss. des Bouches du Rhone,' p. 168, Pl. 23, fig. 1, which appears from representation very closely to resemble our own, and when the specimens themselves can be compared, may probably be found to belong to the same species. The only difference I can observe on comparing the figure is that the umbo of the French fossil is rather the more prominent of the two.

6. Unio tumescens, *Edwards*, MS. Tab. XX, fig. 17, *a*, *b*.

Spec. Char. U. testâ transversâ, irregulariter ovatâ, tumidiusculâ, valdè inæquilaterali, lævigatâ; pedi-regione convexâ, siphoni-regione productâ, subcuneatâ; umbonibus prominulis; lunulâ sub-excavatâ; cardine angusto, dente cardinali obtuso, dente laterali elongato.

Shell transverse, irregularly ovate or ovately wedge-shaped, somewhat tumid, very inequilateral; pedal region rounded, siphonal region produced; umbones slightly prominent and rugose; lunule shallow; cardinal teeth obtuse, lateral tooth elongated and narrow.

Length, 1¾ inch.

Locality. Headon Hill (*Edwards*).

A few specimens corresponding to the above characters are in Mr. Edwards's cabinet, which he has considered to be distinct. I am unable to refer them to any published species.

7. Unio Vectensis, *Edwards*, MS. Tab. XX, fig. 15.

Spec. Char. U. testâ obtusè ovatâ, vel ovato-rotundatâ, inflatâ, gibbosâ, crassâ, lævigatâ; umbonibus magnis, sub-prominulis; pedi-regione rotundatâ, siphoni-regione obliquè truncatâ vel obtusè angulatâ; margine dorsali conveviusculâ; margine ventrali subplanatâ.

Shell obtusely ovate or ovately rounded, inflated, thick, smooth; beaks slightly prominent; pedilateral margin rounded, siphonilateral obliquely truncated or sloping and rounded; pedal region one third the length of the shell; dorsal margin convex; ventral margin slightly curved.

Length, 1½ inch; *height*, 1 inch.

Locality. Headon Hill, (*Edwards*).

I have seen but one specimen, and this appears to be so very different in outline that, with Mr. Edwards, I believe it to be quite distinct; I have therefore adopted the MS. name he has given to it.

Tab. XX, f. 19, represents a specimen of this genus from Headon Hill which I cannot satisfactorily assign to any of the foregoing, or to any other species known to me; at the same time I am unwilling to consider it as entitled to a distinct specific position. I think it possible it may be a distortion, and until better specimens be found it must remain under the name of *U. tumescens* var. *Headonensis*.

VERTICORDIA. *S. Wood*, 1844.

Generic Character. Shell subcircular, equivalved, subequilateral, closed, nacreous; ornamented with radiating costæ or striæ; umbo subspiral or incurved; hinge narrow, with an obtuse tooth in the right valve and a depression in the left for its reception; lunule small, deep-seated, heart-shaped; adductor muscles more or less ovate; palleal line simple or without inflexion; connexus cartilaginous, with a very slight extension outside the dorsal margin; an ossicle in the hinge of the living shell.

Much uncertainty has hitherto existed respecting the position of this genus. Mr. A. Adams, when he first described a species which he obtained near the Gotto Islands, Japan, considered it to be allied to the *Bucardiidæ* (*Isocardia*), but subsequently, from further examination, he says (in the 'Annals and Nat. Hist.,' May, 1863, p. 100), "I may take the opportunity of stating that the true position of the genus (*Verticordia*) is in *Anatinidæ* and not with *Isocardia*, with which in a former communication I had associated it. My brother, in examining one of my fresh specimens, has proved the existence of an ossicle in the hinge very similar to that in *Chamostrea* or *Cleidotherus*."

The late Dr. S. P. Woodward and M. Deshayes placed it in the family *Trigoniadæ*. In *Trigonia* the mantle of the only known recent species is said to be open all round; foot large, long, and geniculate. In *Anatinidæ* the genus *Lyonsia* has an ossicle, but *Pandora* has not; both these genera have a nacreous texture. *Anatina*, *Thracia*, and *Cochlodesma* have an ossicle, but are only partially nacreous. The animals of all these have the mantle prolonged into siphons. In *Verticordia* the shell is nacreous and the hinge has an ossicle, but it is one of the *Integropallealia* with a different form of shell, and is more or less costated. I do not think it can belong to the *Anatinidæ*, though I confess not to know its near relations. I would rather place it in a family by itself—"*Verticordidæ*." The genus seems to have some affinity to *Poromya*, perhaps to *Cardilia* and *Mytilimeria*, and in its costated form to that of the *Carditidæ*. I am unable to trace a connection, however remote, that it could have had to any ancestral relation of a Secondary period. The nearest resemblance in outward appearance is a striated *Isocardia* from the Kimmeridge Clay, called *Anisocardia*, which is not unlike *Chama arietina*, Brocchi, a species belonging to this genus, and a shell that is striated, but not costated. The ossicle in the hinge forms the connecting link which this genus is supposed to have with the *Anatinidæ*.[1] Respecting the use of this ossicle Mr. Jeffreys says, in 'Brit. Conch.,' vol. iii, p. 29, "It was conjectured by Clark that it acted like

[1] In the 'Brit. Mollusca,' vol. xi, p. 76, it is said, "Professor Lovén has detected a rudimentary ossicle in *Montacuta bidentata*, which appears to Mr. Alder, who has likewise observed it, a mere calcification of the lower part of the ligament. It is so easily detached that very few cabinet specimens ever exhibit it."

the cheek-tape of a trunk, to prevent its being opened too widely. This might be so if it were attached to the shell. I should be disposed to attribute to it quite a contrary action, and to believe that its use may be to strengthen the hinge and to prevent its being squeezed too closely and broken, as is frequently the case with certain species of *Anatina* and *Thracia*." The ossicle in *Verticordia* is convex on one side and concave on the other, and the concave side fits over a tubular projection under the dorsal margin of the left valve, in which the cartilaginous connector is inserted. In the right valve the connector is naked or unprotected, extending backwards within the margin a little beyond the ossicle joining the portion of the left valve; this ossicle reduces the large space between the two umbones, and is a partial ossification of the internal connector, appearing to support the cartilage by a closer and more direct action in counteracting the contraction of the adductors instead of a long lateral extension across the deep umbonal region. My Crag species is thick, strong, and convex, and among about a hundred specimens (good and bad) that I have collected from the Coralline Crag I have never seen one fractured in the umbonal region; its large adductors and projecting riblets must enable the animal to firmly close itself within the shell. The absence of the ossicle in *Pandora* may be from the form of the valves, the upper one being somewhat convex *internally*, by which the connector would have a nearer and more direct or vertical action.

In my Monograph of the 'Crag Moll.,' vol. ii, p. 150, the Crag species was thought to be the same as a fossil from Calabria, figured by M. Philippi under the generic name of *Hippagus*, which I adopted. Dr. Lea, who proposed the name of *Hippagus*, has lately sent to Mr. Jeffreys a specimen of the American fossil so called. This appears to belong to the family *Mytilidæ*, and in no way related to *Verticordia*. I have therefore resumed the generic name proposed for this Crag shell when first figured in 'Min. Conch.,' t. 639, in 1844, viz. *Verticordia*, and I purpose here to introduce some Eocene shells in it. This name *Verticordia*, I should add, was employed by Dr. J. E. Gray in his 'Brit. Mus. Catalogue' for 1840, and he tells me (in letter) that he merely adopted it as my manuscript name; both he and myself then imagining the genus to belong to the *Lucinidæ*.

M. Fischer, in the 'Journ. de Conch.,' vol. x, p. 378, has enumerated five recent species and four fossil, but this number will have to be considerably reduced. One fossil that may be referred to this genus has been long known, and was described as *Chama argentea* in 1797, according to Pecchioli, and in 1852 this shell was proposed as the type of a genus by Meneghini, under the name of *Pecchiolia*.

The four Eocene species I propose here to introduce are very rare and have the two valves united, or at least are the casts of those shells when so existing, and the interiors are not visible, though I have no doubt of their belonging to this genus, and possessing the same kind of hinge as my little Crag shell. M. Deshayes has figured and described one species from the Paris Basin. In the sandy formation of the Coralline Crag the valves, as might be supposed, are separated and displaced, with the ossicle, of course,

removed. In the clayey beds of the Eocene deposits the two valves are in contact, but the margins all round are so closely united that I am unable to see anything like an osselet.

1. Verticordia formosa, *S. Wood.* Tab. XXI, fig. 6 *a*, *b*.

Spec. Char. V. Testâ minimâ, suborbiculari, vel sphæroideâ, tumidâ, inflatâ, tenui, inæquilaterali, costatâ; costis paucis, distantibus, intermediis, striatis; umbonibus prominentibus; lunulâ parvâ, profundâ; apice acutâ, valdè incurvatâ; marginibus crenulatis.

Shell small, very tumid, thin, inequilateral, with a few large radiating riblets, and wide interspaces covered with striæ; beaks small, incurved, rather prominent; lunule small, deep; margins crenulated.

Diameter, $\frac{1}{4}$ of an inch.

Locality. London Clay, Whetstone (*Wetherell*).

A single specimen, unfortunately not in good condition, is in the cabinet of Mr. Wetherell, and as this came from a well-digging it may be some time ere another presents itself. I am glad to have the opportunity of bringing it into notice, which the owner has kindly permitted me to do. Although not perfect, there is a small portion of the exterior of the shell remaining, and from this I imagine it did not possess more than half the number of riblets that there are upon *sulcata*, perhaps not more than a dozen; these are not large nor very much elevated; they stand far apart, with a broad intervening space, and in this there are about three or four intermediate smaller rays or coarse striæ. It has some slight resemblance to *Trigonulina ornata* (D'Orbigny).

2. Verticordia obliquata, *Edwards*, MS. Tab. XXI, fig. 8, *a*, *b*.

Spec. Char. V. Testâ minimâ suborbiculari, tumidâ, inflatâ, tenui, fragili; valdè inæquilaterali; costatâ vel striolatâ, costulis circa 26, *convexiusculis; umbonibus prominulis, incurvatis, acutis; lunulâ parvâ, profundâ; marginibus crenulatis.*

Shell minute, orbicular, tumid, and inflated, thin and fragile; very inequilateral; riblets about 26, rounded; beaks incurved, sharp; umbonal region prominent; lunule small, deep; margins crenulated.

Diameter, $\frac{3}{8}$ths of an inch.

Locality. Bracklesham (*Edwards*).

A single specimen of this species is all that I have seen. It appears to be distinct from the London Clay shell, differing, as it does, in some particulars; it is rather less in size, but this might be from difference in age. The ribs are not so numerous, and they

have a greater curve, especially in the pedal region. The ribs are rounded, and about as broad as the spaces between them, and the exterior appears to have been slightly pustular, both over the ribs as well as between them. The valves are united, and the specimen is not in good condition. (The engraved figure is slightly enlarged.)

3. Verticordia sulcata, *J. Sowerby.* Tab. XXI, fig. 9, *a, b.*

Isocardia sulcata, *J. Sow.* Min. Conch., tab. 295, fig. 4, 1821.
— — *Morris.* Catal. Brit. Foss., p. 204, 1854.

Spec. Char. V. Testâ minimâ, orbiculari vel sphæroideâ, tumidâ, inflatâ, tenui, valdè inæquilaterali, radiato-costulatâ, costulis convexiusculis; umbonibus magnis obliquis incurvatis; lunulâ parvâ, profundâ, ovatâ; marginibus crenulatis.

Shell small, orbicular, or rather spheroidal, tumid, and inflated, thin, very inequilateral, with radiating and somewhat curving ribs; beaks large, obliquely incurved; lunule small, deep, and ovate; margins crenulated.

Diameter, $\frac{7}{16}$ths of an inch.

Localities. London Clay. Potter's Bar and Sheppey (*Edwards*), Whetstone and Chalk Farm (*Wetherell*).

A few specimens only of this species have as yet been found, although they are distributed through several localities. These unfortunately have the two valves united, so that the interior has not yet been seen.

The shell is very tumid, and with the valves united is nearly spherical; the riblets or costulæ appear to have been nearly convex; but there is so little of the true shell or exterior remaining, that I am unable positively to say what was the correct shape of these ribs; the spaces between them appear to have been about the same breadth; the umbo tumid and prominent, with the beaks much inflexed and very excentric, curving over a deep lunular depression. Pyritous casts are also found at Sheppey.

4. Verticordia propinqua, *S. Wood.* Tab. XXI, fig. 7.

The specimen from which my figure is taken is merely a cast; it comes from the cabinet of Mr. Edwards, and, from its possessing a larger number of ribs or riblets and being more oblique in outline than any of the other species, I have presumed it to be distinct. It is from a cutting in the London Clay at Highgate. The name is, however, provisional, and it is figured for the purpose of calling attention to its existence.

The nacreous composition of these shells seems to have been unfavorable to their preservation.

CARDITA. *Bruguière*, 1789.

Generic Character. Shell thick, strong, equivalved, closed, oblong, or suborbicular; ornamented externally with radiating ribs or costæ, more or less elevated; hinge with two teeth in the right valve, interlocking, one short and straight, the other oblique and elongated, with one small lateral tooth; impression of pedal muscle close to the oral adductor; mantle-mark without a sinus; connexus ligamental.

Animal with the edges of the mantle disunited except at the siphonal extremity, where they are connected to form two short siphons; branchial margin cirrated; foot elongated.

The genus, as here employed, is intended to comprise all those transverse or elongated forms that were for some time considered to be entitled to generic isolation under the name *Venericardia*, as well as those which are circular or lenticular, possessing the same kind of hinge. The line of separation between the transverse and the orbicular is so indistinct that it is not possible to define it. Nearly all conchologists are now agreed to employ but one generic name, and the above is the older of the two.

The exterior of the shell has generally radiating and elevated costæ, but there are some small species with the characteristic form of dentition in which this character is lost, the surface not only becoming smooth, but a few have ridges produced by elevated lines of growth in a transverse or concentric, and occasionally in an oblique direction.

These latter species closely approach the genus *Astarte*, differing only in having an elongated and oblique tooth in the hinge of each valve. The margins of these small species are denticulated; but, unlike those of *Astarte*, they appear to be thus ornamented at all ages. Those species whose shells are furnished with coarse, elevated, and radiating ridges have them produced beyond the margin, where they interlock the one with the other; but the small smooth species have the crenulations imposed upon the inner margin of the shell. These are quite independent of any external rays, and the animal which forms them has probably fimbriated edges to the margins of the mantle. The thick and ponderous species not only firmly interlock by the projecting ridges at the margin, but the animals are furnished with powerful adductors, deeply implanted in the interior of the shell, implying thereby considerable force for closing the valves. It is said that the animal spins a byssus with its foot. All the species I have seen are capable of firmly closing the ventral margin of the valves, and appear to be free species.

In the recent state the shells are covered with an epidermis. The genus has a wide geographical extension, but it has more of a tropical or subtropical character than otherwise; one species is living on the coast of Ochotsk, while some inhabit the seas of the torrid zone. Its vertical range is also great, extending to 150 fathoms. The animals prefer a sandy bottom. In a fossil state it is found as low as the Trias. The species

present very considerable variation in regard to magnitude. *C. planicosta* measures 5 inches in diameter, while *C. atomus* is, according to M. Deshayes, only 1 millimètre in diameter; but they all possess considerable solidity.

1. Cardita acuticostata? *Lamarck.* Tab. XXII, fig. 5, *a*, *b*.

Venericardia acuticostata (?),	*Lamarck.*	An. du Mus., t. vii, p. 57, No. 4, 1807.
—	—	*Desh.* Coq. foss. des Env. de Par., t. i, p. 153, pl. 25, figs. 7, 8, 1825.
Cardita	—	*Nyst.* Coq. foss. de Belg., p. 208, pl. 16, fig. 6? 1843.
—	—	*J. Sow.* In Dixon's Geol. of Sussex, p. 92, 1850.
—	—	*Desh.* An. sans Vert. du Bass. de Par., t. i, p. 760, 1858.
Cardium serrigerum,	*Lamarck.*	An. sans Vert., t. vi, p. 19, No. 8, fide Desh., 1819.

Spec. Char. "*C. Testâ subrotundâ, tumidâ, cordiformi, subobliquâ, crebricostatâ, costis angustis, angulatis, squamoso-serratis, anticis duplicatis.*" (*Deshayes.*)

Shell suborbicular, tumid, heart-shaped, slightly oblique, costated; ribs narrow, angulated with squamose tubercles.

Diameter, $\frac{5}{8}$ths of an inch.

Locality. Bracklesham (*Edwards*).

France: Chaumont, Grignon, Parnes, Courtagnon (*Deshayes*).

Belgium: Aeltre, près de Bruges (*Nyst*).

Asia Minor, sec. Deshayes: Egypt, fide Bellardi.

M. Deshayes, as above referred to, speaks of this species as a British fossil, but as differing from the French shell in the number of costæ. He observes, "Dans l'espèce d'Angleterre ces côtes sont au nombre de vingt seulement; on en compte trente, quelquefois trente deux dans l'*acuticostata*." Our shell has 24 to 26 costæ, and appears to correspond better with the Belgian fossil of that name, which is said to have 26. The costæ upon our specimens are more or less imbricated all over, but especially so on those in the pedal region. The ribs have a central keel, and there is a faint ray on each side, dividing the rib, as it were, into four parts, two on each side of the central keel. This appears to differ from *C. carinata* of 'Min. Conch.' in being less elongated, and in the ribs being more regularly nodulous.

Fig. 11, Tab. XXII, represents a specimen from Bramshaw; it has on the tablet the MS. name of *C. asperrima*. It is intermediate between *acuticostata* and *carinata*, but is not, I think, sufficiently distinct to form a species of itself, but an abnormal form, and for the present it is placed as a var.—*C. acuticostata*, var. *asperrima*.

2. Cardita alticostata, *S. Wood.* Tab. XXI, fig. 3.

Spec. Char. C. Testâ minimâ, orbiculari, turgidâ, subinæquilaterali, radiatim costatâ, costis circa 13 *elevatis acutis compressis utrinque nodulosis; umbonibus minutis, obliquis, depressis, subincurvatis; lunulâ minutâ.*

Shell small, orbicular, and nearly spherical, nearly equilateral, costated with about 13 elevated ribs; beaks small, oblique, depressed, slightly incurved; lunule small.

Diameter, $\frac{1}{4}$th of an inch.

Locality. London Clay, Highgate (*Edwards*).

One pretty little specimen is in Mr. Edwards's cabinet, and this appears to me to be entitled to a specific position; its principal distinction is an elevated and compressed rib, the lower part of which is angular; on the top of this angle is an elevated ridge, not very sharp; on each side of these ridges are some large and distinct nodules, but the centre is smooth.

3. Cardita Brongniartii, *Mantell.* Tab. XXII, fig. 9.

Cardita Brongniartii, *Mant.* Geol. of the South East of Engl., p. 368, 1833.
— — *J. Sow.* In Dixon's Geol. of Suss., pp. 116, 225, t. xiv, fig. 33, 1850.

Spec. Char. C. Testâ transversâ, irregulariter ovatâ, vel obliquè subtriangulatâ, valdè inæquilaterali, crassâ, tumidiusculâ; siphoni-regione subangulatâ; radiatim costatâ, costis 30—32 *depressis, rugosis; umbonibus subprominentibus lunulâ minimâ profundâ: cardine crassiusculo.*

Shell transverse, irregularly ovate or obliquely subtriangular; very inequilateral, thick, slightly tumid, siphonal region roundedly triangular; costated, ribs about 30, rough and depressed; umbones not prominent; lunule heart-shaped, small and deep; hinge moderately thick.

Length, 2 inches; *height*, $1\frac{1}{2}$ inch.

Localities. London Clay, Bognor. Var., fig. 12, *a*, *b*, Tab. XXII, Clarendon.

This species is, I believe, peculiar to England, and it has been long known from the locality of Bognor. Mr. Edwards's cabinet contains also a large suite of specimens from Clarendon. This latter shell is here placed as a variety; it differs somewhat in form, being less elongated, and has considerable resemblance to *planicosta*, but it is never so large as that species, nor the ribs so flat. Called by Mr. Edwards *Clarendonensis*.

4. Cardita carinata, *J. Sowerby*. Tab. XXII, fig. 15, *a*, *b*.

Venericardia carinata, *J. Sow.* Min. Conch., t. 259, fig. 2, 1820.

Spec. Char. C. Testâ elongato-transversâ vel ovato-oblongâ, compressiusculâ, tenui, valdè inæquilaterali, radiatim costatâ, costis 20—22, *angulatis, carinatis, et nodulosis; margine ventrali convexiusculis; umbonibus minimis, obliquis, depressis; lunulâ minutissimâ, profundâ, lævigatâ; cardine angusto, dentibus elongatis.*

Shell elongately transverse or ovately oblong, slightly compressed, thin, very inequilateral; radiatingly costated with 20 to 22 angular, carinated, and nodulous ribs; ventral margin slightly curved; beaks small, depressed, lunule deep and smooth; hinge narrow, teeth elongated.

Length, $1\frac{1}{4}$ inch; *height*, $\frac{7}{8}$ths of an inch.

Locality. Bracklesham Bay.

This is an elegant species, and by no means rare at the above locality, to which it appears to be restricted. The shells are thinner and more fragile than those of the generality of species in this genus. The ribs upon this species are triangular and obsoletely tricarinate, that is to say, there are two faint rays, one on each side of the regular keel, which is in perfect specimens ornamented with nodules; the bases of the ribs meet, and there is no flat part in the interspaces. The siphonal region is rather compressed, or not so tumid as the pedal side. The interior is thickened in aged specimens, and the muscle-marks then deeply impressed.

5. Cardita crebrisulcata, *Edwards*, MS. Tab. XXII, figs. 4 and 8.

Spec. Char. C. Testâ suborbiculari, inæquilaterali, turgidâ, crassâ, subsphæricâ, radiatim costatâ, costis 20—24, *angustis, squamosis, squamulis imbricatis; umbonibus parum obliquis, cordatis; lunulâ lævigatâ, concaviusculâ; cardine angusto, dente unico in valvâ dextrâ elongato; dentibus duobus in alterâ valvâ.*

Shell suborbicular, inequilateral, tumid, thick, nearly spherical; costated ribs 20—24, narrow, and ornamented with numerous fine imbrications; umbones slightly oblique, heart-shaped; lunule short, smooth, slightly depressed; hinge narrow; one elongated tooth in right valve, with a narrow depression in the left.

Diameter, $\frac{5}{8}$ths of an inch.

Localities. Bramshaw and Huntingbridge (*Edwards*).

This much resembles *sulcata*, but it has a larger number of ribs, and these are more prominent, nodulous and imbricated; the interspaces are narrow and deep.

There are also some other specimens, to which is attached the name of *subprofunda*

(Tab. XXII, fig. 2, from Brook), which appear to me to be a variety of this species. These are not quite so much inflated; they resemble much the figure and description of *C. Aizyensis*, Desh., differing slightly in the ornamentation. Our shells are not quite orbicular, but have a greater diameter from the umbo to the ventral margin than in the opposite direction.

6. Cardita Davidsoni, *Deshayes.* Tab. XXII, fig. 17, *a*, *b*.

Cardita Davidsoni, *Desh.* An. sans Vert. du Bas. de Par., t. i, p. 764, pl. 60, figs. 10—12, 1860.

Spec. Char. C. Testâ orbiculato-subtrigonulâ, depressiusculâ, crassâ, inæquilaterali, radiatim costatâ, costis 17—19 *angustis, distantibus, obsoletè tricarinatis; crenato-squamosis, interstitiis latis, irregulariter striatis; umbonibus acutis; lunulâ minimâ, lævigatâ; cardine crassiusculo.*

Shell roundedly trigonular, somewhat depressed, thick, inequilateral; costated ribs 17—19, distant, narrow, and obsoletely triangular; outer keel covered with rather distant squamose tubercles; interstices broad, and covered with concentric striæ or irregular lines of growth; beaks sharp, lunule small and smooth.

Diameter, $\frac{5}{8}$ths of an inch.

Locality. Barton.

France: Ver. Ermonville (*Desh.*).

This species is by no means rare in England at the above locality; it much resembles *C. sulcata*, but it is not so tumid, the costæ are fewer, more distant, the tubercles on the ribs are not so numerous, the ribs are more angulated and not so rounded, and there is generally a distinct line on each side of the keel. The elongated tooth is nearly parallel with the ligamental fulcrum extending laterally beyond it. The valves are not so frequently found united as are those of *sulcata*.

7. Cardita deltoidea, *J. Sowerby.* Tab. XXII, fig. 7, *a*, *b*.

Venericardia deltoidea, *J. Sow.* Min. Conch., tab. 259, fig. 1, 1821.
— latisulcata, *Nyst.* Coq. foss. de Belg., p. 209, pl. xv, fig. 5, *a*, *b*, 1843, fide Von Könen.

Spec. Char. C. Testâ obliquâ, subtrigonâ vel deltoideâ, crassâ, convexiusculâ, inæquilaterali, radiatim costatâ, costis 15—18 *acutis, elevatis, distantibus; lunulâ magnâ, lævigatâ, depressâ; umbonibus elevatis, incurvis, obliquis; cardine crassissimo.*

Shell oblique, subtrigonular or deltoidal, thick and strong, slightly convex, inequi-

lateral; costated with 15 to 18 sharp, elevated, and somewhat distant ribs; lunule large, smooth, depressed; beaks prominent, slightly incurved; hinge very thick.

Diameter, $1\frac{1}{8}$th of an inch.

Locality. Lyndhurst (*J. Sowerby*); Brockenhurst (*Edwards*).
Belgium: Hoesselt, Vliermaet, and Lethen (*Nyst*).

This is a handsome shell, and it is more readily distinguished than the generality of species in this genus; its deltoid form and great elevation of umbo are its most prominent features. The costæ are distant, especially towards the pedal region, triangular in shape, with broad interspaces; the top of the rib is small, not sharp, rather flattened, but narrow; the hinge is broad in consequence of its elevated umbo, teeth large, and the muscle-marks deeply impressed. It is, I am told, abundant at Brockenhurst, where the valves are frequently found united. In Morris's 'Cat. Brit. Foss.' it is quoted from Barton, but I have not seen it from that locality.

8. Cardita elegans, *Lamarck*. Tab. XXII, fig. 16, *a*, *b*.

Venericardia elegans,	*Lam.*	An. du Mus., t. vii, p. 59, No. 10, and t. ix, pl. 32, fig. 3, *a*, *b*. 1807.
—	—	*Desh.*	Hist. des An. des Env. de Par., t. i, p. 157, pl. 26, figs. 14—16. 1824.
Cardita	—	*Nyst.*	Coq. foss. de Belg., p. 215, pl. 17, fig. 2, 1843.
—	—	*J. Sow.*	In Dixon's Geol. of Suss., p. 169, pl. 3, fig. 15. 1850.
—	—	*Desh.*	An. sans Vert. du Bass. de Par., t. i, p. 772, 1859.

Spec. Char. C. "*Testâ subrotundâ, depressiusculâ, tenuè costatâ; costis numerosis, compressis, eleganter squamosis; lunulâ ovato-lanceolatâ.*" (*Deshayes.*)

Shell somewhat rounded and slightly depressed, with numerous ribs, thin, compressed, and elegantly ornamented; lunule ovately elongated.

Diameter, $\frac{3}{8}$ths of an inch.

Localities. Bracklesham, Stubbington (*Edwards*).
France: Grignon, La Montagne de Laon, Soissonais (*Deshayes*).
Belgium: Forêt, Laeken (*Nyst*).

This species is by no means rare in England, and I believe it is also abundant in France; it much resembles the young state of *C. imbricata*, but our present shell never attains to the magnitude of that species; it differs in being rather more tumid, and there is also a slight difference in the costæ, which in this species are less numerous, varying from 17 to 20; there is likewise a greater interspace between the ribs, and the ribs themselves are more nodulous than they are in *imbricata*.

There is a variety from Bramshaw, in which the ribs are sharper and higher (var. *subelegans*).

9. Cardita imbricata, *Lamarck*. Tab. XXI, fig. 10.

Venus imbricata, *Chen*. Conch. Cab., t. vi, t. 30, figs. 314, 315, 1782.
— Ency. Meth., pl. 274, fig. 4, *a*, *b*.
— imbricata, *Gmel*. Syst. Nat., p. 3277, No. 34, 1815.
— — *Lamarck*. An. du Mus., t. ix, pl. 32, fig. 1.
Venericardia — *Bronn*. Syst. der Urw., p. 51, pl. 4, fig. 7, 1824.
— — *Desh*. Coq. foss. des Env. de Par., t. i, p. 152, pl. 24, figs. 4, 5, 1824.
Cardita — *Nyst*. Coq. foss. de Belg., p. 209, No. 167, 1843.
— — *Desh*. An. sans Vert. du Bas. de Par., t. i, p. 759, 1860.

Spec. Char. C. Testâ crassâ, suborbiculatâ, cordiformi, subobliquâ, inæquilaterali; radiatim costatâ costis numerosis, convexis, separatis, imbricato-squamosis; umbonibus subelevatis obliquis, cordatis; lunulâ minimâ profundissimâ.

Shell thick and strong, suborbicular, oblique, inequilateral, costated; ribs numerous, convex, distinctly separated, covered with imbricated nodules; beaks small, slightly incurved, and heart-shaped; lunule minute and deep.

Diameter, $1\frac{1}{2}$ inch.

Locality. Bracklesham Bay.
France: Montmirail, Grignon, Courtagnon, &c. (*Desh.*).
Belgium: Forêt, Laeken, Gand (*Nyst*).
Asia Minor: Zafranboli (*Desh.*).

This is rare in England, and I have seen only one specimen. It is very abundant at Grignon. In these the large oblique tooth of the left valve extends as far as the ligamental fulcrum, and in perfect specimens this tooth is vertically striated.

M. Nyst has considered this species in his description as probably identical with *Venericardia rotunda*, Lea, to which certainly it bears resemblance; but from the description by Lea the ribs of his shell appear to be more thickly imbricated, and his figure does not represent it as so oblique.

The variety called *spissa* by D'Orbigny I do not know.

10. Cardita mitis? *Lamarck*. Tab. XXII, fig. 3, *a*, *b*.

Venericardia mitis? *Lamarck*. An. sans Vert., t. v, p. 611, No. 6, 1805.
— —? *Desh*. Coq. foss. des Env. de Par., t. i, p. 155, pl. 25, figs. 9, 10, 1824.
Cardita — *J. Sow*. In Dixon's Geol. of Suss., p. 92, 1850.

Spec. Char. C. Testâ rotundato-subobliquâ, crassiusculâ, tumidâ, cordiformi, inæquilaterali, costatâ, costis 23—26, *in medio lævigatis, convexis, utroque leviter granosis.*

Shell orbicular, slightly oblique, not very thick; tumid, heart-shaped, inequilateral; costated, ribs 23—26, convex and smooth on the centre of the shell, slightly granular on each side, particularly those in the pedal region.

Diameter $\frac{1}{2}$ an inch.

Localities. Bracklesham, Selsey, Brook (*Edwards*).

In Mr. Dixon's work, and also in Mr. Morris's 'Catalogue of Brit. Fossils,' is the name of *C. mitis*. The specimen from which our figure is taken has likewise the same name in MS., and I have therefore here retained it, although it does not fully accord with the description of the French species of that name. M. Deshayes considered his shell entitled to be separated from *C. planicosta* (the young of which it much resembles), principally on account of the difference in number of costæ, which in *mitis* are said to be as many as thirty-nine, while in *planicosta* there are not more than thirty, and this latter number is the full extent of what our shell possesses. Still, I think our British fossil is not the young of *planicosta*, as it differs in outward form in being more orbicular, more tumid, and less oblique, and the ribs in *planicosta* are flatter even in the young shell than they are in our present species. In this shell the costæ in the pedal region are covered with obtuse tubercles or nodules, and the ribs are not wider than the interspaces.

11. Cardita obovata, *Edwards*, MS. Tab. XXII, fig. 13.

Spec. Char. C. Testâ transversâ, elongatâ, oblongâ vel subquadrangulari; valdè inæquilaterali, radiatim costatâ, costis numerosis depressis, subplanatis; umbonibus obliquis, depressis; lunulâ parvâ, cordiformi; cardine crassiusculo.

Shell transverse, elongate, oblong or irregularly quadrangular, very inequilateral; costated ribs numerous, somewhat depressed; lunule small concave, heart-shaped; hinge moderately thick.

Length, $\frac{7}{8}$ths of an inch; *height*, $\frac{3}{4}$ths of an inch.

Locality. Bracklesham.

Two specimens are in Mr. Edwards's cabinet, to which he has given the above name, and I have provisionally adopted the separation he has made. The form of the shell is different from that of any other except *carinata*, to which it may, perhaps, be referred as a variety; but our present species has a greater number of ribs (thirty), whereas in *carinata* there are only twenty-two. In this the costæ are not so angular, and they are more nodulous.

12. Cardita oblonga, *J. Sowerby*. Tab. XXII, fig. 14, *a*, *b*.

Venericardia oblonga, *J. Sow.* Min. Conch., t. 289, fig. 2, 1821.

Spec. Char. C. Testâ transversâ, oblongâ, crassiusculâ, subquadrangulari, valdè inæquilaterali; radiatim costatâ, costis 13—15, *elevatis, tuberculosis; umbonibus depressis; lunulâ parvâ, cordiformi; cardine crassiusculo.*

Shell transverse, oblong, subquadrangular, thick, strong, very inequilateral; costated with 13—15 tuberculated ribs; beaks depressed; lunule small, heart-shaped, depressed; hinge moderate.

Length, $\frac{11}{16}$ths of an inch; *height*, $\frac{1}{2}$ an inch.

Localities. Barton, Hordle, Highcliff, Bracklesham (*Edwards*).

This is a pretty species, and abundant at Barton. The umbo sometimes extends beyond the pedilateral margin, and the hinge is quite at the extremity of the shell; the ventral margin in some specimens has a slight curve inwardly, with the impression of adductors large and distinct; the ribs are covered with nodules, and they are about as wide as the depressed spaces between them.

Mr. J. Sowerby, in 'Min. Conch.,' says that it occurs in France, but I have not been able to ascertain its locality.

In two or three of these oblong species there is a small distinct denticle on the pedal side of the hinge in the left valve, with a depression for its reception in the right; this is immediately above the impression of the pedal muscle. Fig. 18, Tab. XXII, represents what I at first thought might be specifically distinct, the umbo projecting beyond the margin, with more depressed and rounded ribs, which are less tuberculated; but I believe it to be only a variety (*C. oblonga*, var. *transversa*). It is from the Fluvio-marine at Hordle.

Fig. 10, Tab. XXII, represents another form, probably, of this species; it had in MS. the name *C. serratina*. It is not so tumid as the normal form, it is less transverse, and the costæ are more regularly nodulous. I think it is only a variety It was found at Mead End, Headon Hill, and Barton.

Fig. 11, Tab. XXI, represents a small specimen in Mr. Edwards's cabinet, which at one time I thought might be a distinct species; but having only one specimen, and that, perhaps, distorted, I have considered it as a variety (*C. oblonga*, var. *trapezoidalis*). It is from High Cliff, Barton.

13. Cardita paucicostata, *Sandberger*. Tab. XXII, fig. 6, *a*, *b*, *c*.

Cardita paucicostata, *Sandb.* Conch. d. Mainz. Beckens, p. 337, t. 24, f. 6, 1863.

Spec. Char. C. Testâ rotundato-trigonulâ, crassâ, conveviusculâ, costatâ, costis paucis, elevatis, nodosis, distantibus; subinæquilaterali; lunulâ brevi, concavâ; umbonibus obliquis

cordatis; cardine crassiusculo, in valvulâ dextrâ dente elongato, in valvulâ sinistrâ dentibus duobus obliquis.

Shell roundly trigonal, thick, and slightly convex; costated, ribs few, elevated, and distant; shell slightly equilateral; lunule concave; beaks prominent and oblique; hinge thick, one tooth in the right valve elongate and oblique, with two in the left valve interlocking.

Diameter, $\frac{1}{4}$ of an inch.

Locality. Headon Hill, Roydon (*Edwards*).

This shell does not appear to be rare. I have referred it to Sandberger's species, depending upon his description and figure. Its principal distinction is a paucity of ribs, not amounting to more than fourteen or fifteen; these are narrow and distant on the pedal side, with large and flat interspaces between them. The ribs are covered with regularly placed nodules, not imbricated. It is named in Mr. Edwards's cabinet *Cardita nodicostata*, and considered by him as distinct, in consequence of the ribs being more nodulous or ornamented.

14. Cardita planicosta, *Lamarck*. Tab. XXI, fig. 5, *a—d*.

Knorr. Petrif., part 2, tab. 23, fig. 5. 1755.
Seba. Thesaurus, vol. iv, pl. 106, fig. 36, 1765.
Venericardia planicosta, *Lamarck.* An. du Mus., t. vii, p. 55; and t. ix, pl. 31, fig. 10, 1807.
— — *J. Sowerby.* Min. Conch., t. l, 1814.
— — *Desh.* Coq. foss. des Env. de Par., t. i, p. 149, pl. 42, figs. 1—3. 1824.
— — *Bronn.* Lethæa Geogn., t. xi, p. 946, pl. 38, fig. 7, 1836.
Cardita — *Nyst.* Coq. foss. de Belg., p. 205, pl. 17, fig. 1, 1843.
— — *Conrad.* Foss. Shells of the Tert. Form. of N. Amer., p. 20, t. v, fig. 2, 1832.
— — *J. Sow.* In Dixon's Geol. of Suss., pp. 92, 169, pl. 2, figs. 14, 18, 1850.
var. minor, Venericardia suessoniensis, *D'Archiac.* Desc. Geol. du Dep. de l'Aisne, p. 272, fide Desh.

Spec. Char. C. Testâ magnâ, ovato-obliquatâ, cordatâ, crassissimâ, radiatim costatâ, costis planulatis; apice acutâ incurvatâ, aliquando granulatâ; lunulâ profundissimâ, latâ, cordatâ; margine crenato; dentibus cardinalibus binis, tenuissimè striatis.

Shell large, obliquely ovate, heart-shaped, very thick; costated, ribs broad and flat; umbonal region prominent, sometimes granulated; lunule deeply impressed, heart-shaped; margin dentated; cardinal teeth two, finely striated transversely.

Diameter, $4\frac{1}{4}$ inches.

Localities. Britain: Bracklesham, Bramshaw, Brook, Stubbington, Selsey, Alum Bay (*Edwards*). Bagshot and Hawley (*fide R. Jones*).

France: Sables inférieurs, Calcaire grossier, Sables moyens (*Deshayes*), Faluns de Touraine? (*Desh.*).

Belgium: Gand, Lovain, &c. (*Nyst*).

North America: Claiborne, Alabama (*Conrad*).

This species is abundant in individuals, and may be obtained, of all ages and all sizes, on the beach at Bracklesham. M. Deshayes speaks of it as also abundant in France, where it is disseminated through a series of deposits. I have never seen it from Barton. It is a very handsome shell, and its great solidity has been favourable to its preservation.

The interior of the shell in aged specimens is often much thickened, by which means the impressions of the adductors are deeply seated. This animal has also left two small distinct, and deep impressions by the pedal muscles, the one above the oral, the other over the anal adductor, indicating, probably, the possession of a large and falcated foot. The hinge is variable; in some specimens it is very thick, with an elevated umbo, in others it is correspondingly depressed, with a narrow hinge-line, and the contour of the shell is very variable, some specimens being considerably higher than they are long, while others have the length greater than the height.

In the young state the ribs are generally more or less rounded, but they become flat with the increase of age, and in old specimens the ribs are almost obliterated at the outer edge; they vary in number from twenty-seven to thirty.

This is one of those species possessing a wide geographical range. Sir Charles Lyell gives it as a species from Coggins Point, on the James River, below Richmond, in America ('Proc. Geol. Soc.,' vol. iv, p. 564, 1845), and says it cannot be distinguished from one of the common varieties of the European shell. Mr. Conrad speaks of his shell as having twenty-two ribs.

15. Cardita simplex, *Edwards*, MS. Tab. XXI, fig. 4.

Spec. Char. C. Testâ crassâ, suborbiculatâ, convexâ, inæquilaterali, radiatim costatâ, costis circa 15, *angustis, distantibus, simplicibus, interstitiis latis, lævigatis; umbonibus prominulis; lunulâ minimâ elongatâ; cardine crassiusculo.*

Shell thick, suborbicular, convex, inequilateral, with about 15 radiating ribs, subangular, thin, and distant, spaces between them broad and smooth; beaks slightly elevated, lunule small and elongated, hinge moderately thick.

Diameter, $\frac{1}{2}$ an inch.

Locality. Roydon (*Edwards*).

This does not appear to be abundant. Its principal distinction is in the character of

the ribs, which in this species are free from imbrications, nodules, or rugosities of any kind, rather a rare circumstance with species in this genus.

Fig. 12 of the same plate represents a specimen from High Cliff, Barton, which, I think, may be considered a variety of this species; it has fewer ribs and wider spaces, but it is equally unarmed.

16. Cardita sulcata, *Solander*. Tab. XXII, fig. 1, *a*, *b*.

Chama sulcata, *Sol.* (in Brander). Foss. Hanton., pl. 7, fig. 100, 1776.
Venericardia cor-avium, *Lamarck*. An. du Mus., t. vii, p. 58, No. 7, 1806.
— — *Desh.* Coq. foss. des Env. de Par., t. i, p. 156, pl. 24, figs. 6—8, 1824.
— globosa, *J. Sow.* Min. Conch., t. 289, fig. 1, 1821.
Cardita cor-avium, *d'Orb.* Prod. de Paleont., t. 11, p. 423, No. 1613, 1850.
— sulcata, *Id.* ,, ,, ,,
— — *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 768, 1858.

Spec. Char. C. Testâ rotundato-globosâ, cordiformi, turgidâ, inæquilaterali, radiatim costatâ, costis 16—20, *elevatis, rugosis, convexis, imbricato-squamosis vel nodulosis; lunulâ latâ, profundâ; umbonibus incurvis.*

Shell roundly globose, heart-shaped, tumid, inequilateral; costated, ribs 16—20, elevated, convex, and rugose, covered with coarse imbrications or nodules; lunule broad and deep; beaks incurved.

Diameter, $\frac{3}{4}$ of an inch, nearly.

Locality. Barton.

France: Ezanville, &c., Sables moyens (*Deshayes*).

Prof. Morris and M. Deshayes have both, and I think very justly, restored to this species the name originally given to it by Solander. Probably Lamarck was not aware that his species had been found in England, or had been figured and described in an English work.

This is most abundant as individuals, at Barton, where it may be considered as one of the characteristic species of that deposit. The reason why this appears not to have been referred to *cor-avium* by Mr. Sowerby was a difference in the hinge between the French and English shells; but this is a variation that may be observed among a large suite of specimens of the British fossil, which will be found to exhibit the broad hinge as well as the narrow one, and I believe with the above-mentioned authors that they constitute but one species. There is a variety at the same locality which differs in having the ribs more distinctly covered with nodules, whereas in the typical form the ribs are more rugose and without distinct tubercles. Var. β of J. Sowerby makes an approach towards *C. Davidsoni*, in which the ribs are sharper.

17. Cardita corpusculum, *S. Wood.* Tab. XXI, fig. 1, *a*, *b*.

Diameter, $\frac{1}{2}$ a line.

Locality. Barton (*Edwards*).

A few specimens in Mr. Edwards's cabinet, of a very minute size, appear to belong to this genus, and I have given to them the above name provisionally. They are of a somewhat aberrant character, the cardinal denticle of the right valve being short and triangular, like that of *Astarte*, instead of being elongate. They have also a very distinct and distant lateral tooth on the pedal side, prominent in the left valve, and interlocking in a corresponding depression in the right. From this peculiarity of hinge I have imagined this to be a distinct species, and not the young state of a larger kind; it resembles in size a small species of the Paris basin, figured and described by Prof. Deshayes under the name of *C. atomus*, but it has more numerous and more distinct ribs, and our shell is more orbicular. Four specimens are in Mr. Edwards's cabinet, and two of these possess a circular opening or zoophagous perforation. This is, I believe, *Goodallia granulosa*, Tennant, 'Strat. List Brit. Foss.,' p. 30, 1847.

ASTARTE. *J. Sowerby*, 1816.

Generic Character. Shell sub-triangular, sub-orbicular, or oblong, generally compressed; thick, strong, smooth or concentrically ridged, equivalved, closed; hinge with two diverging cardinal teeth in the left valve, with a triangular space between them for the reception of a prominent tooth of the same form in the right, with generally a lateral tooth or raised margin, and a corresponding depression for its reception in the opposite valve; adductor muscles deeply impressed, with a small pedal one within or above the oral adductor; palleal line without a sinus; connexus ligamental.

Animal with the edges of the mantle disunited; siphonal openings simple, not extending beyond the shell; foot rather small; tongue-shaped.

This genus comprises an interesting group of animals, and is largely developed in the Upper Tertiaries in Europe, as also in America. It is found in this country in Secondary Formations, where species are by no means scarce; and it has been said to indicate by its presence in any fossiliferous deposit the conditions of very diminished temperature; but it occurs in association with Tetrabranchiate Cephalopoda, the supposed inhabitants of warm or tropical regions, and at such an horizon of the London Clay (Highgate and Sheppey) as proves its very close synchronism with, and contiguity to, the gigantic *Ophidia*, *Chelonia*, *Crocodilia*, and rich Flora of Sheppey.

A great many species in this genus (*Astarte*) have the interior margins of the shell ornamented with crenulations, while in others these margins are plain. The same distinction may be seen in the genus *Nucula*, where some species have a crenulated margin, while others are smooth. There is, however, this difference between the two genera—viz., that in *Nucula* the young shell, as well as the old, is furnished with this kind of ornamentation in those species which possess it at any period of their lives; but in the case of *Astarte* it is not so. In the 'Crag Mollusca,' vol. ii, p. 173, I have said, that "in all the species of this genus the young state of the shell has its margin free from crenulations, and never until it has attained to maturity does it assume that character, and whenever a specimen has its margin crenulated, it may be considered to have arrived at its full growth." Mr. Jeffreys appears to be of a contrary opinion, and in his paper entitled "Additional Gleanings," published in the 'Annals and Mag. Nat. Hist.' for September, 1859, p. 5, says of *Ast. triangularis*, "the non-crenation of the margin does not depend on age, for I possess specimens which are evidently adult and of the same age, some of them having the margin quite plain, while in others it is strongly crenulated." Also in 'British Conchology,' vol. ii, p. 309, the same opinion is repeated. If by "evidently adult" it is meant that the full size is attained, I answer that size, though in general a good criterion of age, is not so *always;* there are dwarfs and giants in almost every species; and although occasionally one individual which has its margin crenulated may be *smaller* than another of the same species which has it smooth, it does not necessarily follow that the smaller one is an immature shell, or that the larger one had completely attained to full maturity. It is very difficult—perhaps impossible—to prove it so in this genus, but it bears great probability from an analogous case in the genus *Cypræa*, for example, where the adult state is denoted by an alteration of form. I have found specimens of the *full-grown state* of *Cypræa Europæa* which *in linear measure* is not more than one third the size of the largest adult of the same species, and yet the two extremes may fairly be assumed as full-grown individuals, indicated by their peculiar characters. I have never been able to find, although I have examined thousands of specimens of the genus *Astarte* (which is most abundant in the Coralline Crag), a single individual *with* a crenulated margin which could be assigned to the *young state* of a species which has a margin so ornamented when full grown.

In the diagnosis of the animal of the genus *Astarte* by Messrs. Forbes and Hanley, p. 455, vol. i, it is said, "the mantle is freely open in front, *plain* at the margins." The same *plain* condition of the mantle-margin is confirmed by Mr. Jeffreys, 'Brit. Conch.,' vol. ii, p. 308. Now, in order to produce the knobs which ornament the margin of the valves, I imagine the mantle would be fimbriated or pointed, to enable the animal to deposit calcareous matter in that form; and if it be not so in the young state—as I presume is the case—it would become so in the full-grown animal.

I once thought the fimbriated margin of the mantle might have indicated a sexual difference (see 'Mem. Geol. Surv.,' vol. i, p. 414, 1846), but I now consider the crenu-

lated edge of the shell as probably analogous to the outer lip of some univalves, where the margin of the aperture is denticulated only in the adult state.

This genus does not appear to be present in the Eocene Formations of France; in our own country, I know it only from that portion of the Lower Tertiaries which is inferior to the Bagshot Sands, with the somewhat doubtful exception of the shell figured as *Astarte modicella*.

The Crag shells of this genus, though of thick and solid texture, are frequently perforated by some of the zoophagous feeders, but they seldom show any erosion at the umbones. Both these actions appear peculiar to some deposits only. Some of the older Tertiary specimens are much eroded at the umbones, while others of the same species from another locality are not at all so.

1. Astarte Clarendonensis, *Edwards' MS.* Tab. XXIV, fig. 17 *a*, *b*.

Spec. Char. Testâ magnâ, crassissimâ, irregulariter quadrangulatâ, tumidiusculâ, sublævigatâ, valdè inæquilaterali; pedi-regione brevissimâ, subtruncatâ, alterâ longiore, subquadratâ, compressiusculâ; impressionibus muscularibus profundis; marginibus crenulatis.

Shell large, very thick and strong, irregularly quadrangular, slightly tumid, and nearly smooth; very inequilateral; umbones depressed, very excentric; pedal region short, anal side truncated, and somewhat compressed; muscular impressions deep; margins crenulated.

Length, $1\frac{3}{8}$ inch; *height*, $1\frac{1}{8}$ inch.

Locality. London Clay: Clarendon.

This species has yielded to Mr. Edwards a great number of specimens, but I do not see among them a very young individual, although one has its margin smooth, and as such I presume it is not full grown. The surface where perfect appears to have been nearly smooth, showing only very fine lines of growth. The umbones of all the specimens have been eroded, and I am unable to see if the very young state of the shell was covered with ridges. The shell has a tolerably large lunule not very strongly defined, but this varies according to the tumidity of the individual specimen. The proportional dimensions show considerable variation.

2. Astarte donacina, *J. Sowerby's MS.* Tab. XXIV, fig. 10 *a, b.*

Astarte donacina, *Prestwich.* Quart. Journ. Geol. Soc., vol. iii, p. 401, 1847.
— — *Morris.* Catal. Brit. Foss., p. 188, 1854.

Spec. Char. A. testâ transversâ, inæquilaterali, crassâ, irregulariter quadrangulatâ aut donaciformi, partim lævigatâ, compressiusculâ; pedi-regione brevi, alterâ longiore, subtruncatâ; marginibus crenulatis.

Shell transverse, inequilateral, thick and strong, of an irregularly quadrangular outline, slightly inclining to wedge-shape; pedal region short and rounded; siphonal side truncated; margins crenulated.

Length, 1 inch nearly.

Locality. London Clay; Railway Cutting, Old Basing, near Basingstoke (*Prestwich*).

This is an elegant shell. About half a dozen specimens have been procured by Mr. Prestwich, which he has kindly put into my hands for examination. It is, I think, quite distinct; and as it has passed under the MS. name of *donacina*, I have here adopted it. There is a difference in size among the specimens, all of which have a crenulated margin; but whether the smaller ones be young and immature—thus presenting an exception to the rule previously laid down—I cannot positively say; but I think they are all full-grown specimens. Mr. Prestwich said they came from an horizon about fifty feet higher than that at Clarendon.

3. Astarte rugata, *J. Sowerby.* Tab. XXIV, fig. 13 *a—f.*

Astarte rugata, *J. Sow.* Min. Conch., t. 316. 1821.

Spec. Char. A. testâ crassâ, rugatâ, rotundato-triangulatâ; pedi-regione rotundatâ, siphoni-regione subtruncatâ; inæquilaterali; in juventate rugatâ, vel sulcatâ; umbonibus subprominentibus; lunulâ concavâ, profundâ; margine crenulato.

Shell thick, roundedly triangular; pedal region rounded; siphonal side subquadrate or truncated; inequilateral; in the young state ridged or sulcated; umbones rather prominent; lunule deep and concave; margins crenulated.

Diameter, 1 inch.

Locality. London Clay: Highgate, Hampstead, Potter's Bar, Sheppey (*Edwards*).

Mr. Sowerby, in 'Min. Conch.,' has figured several sizes of this shell, which are no oubt from specimens of various ages; the larger one only has the inner margin, with

crenulations. In the older shells the umbones are much eroded, and only slightly so in the younger specimens. This probably arises from the one possessing more animal matter than the other. Old shells are more easily decomposed.

Specimens from different localities present considerable differences from each other: those from Highgate are nearly smooth, except at the umbones. One specimen from Potter's Bar (fig. 13, *d*) is perfect at the umbo, which is much elevated, giving it a different outline; but I think it is merely a variety (*umbonata*). Figs. 13 *a* and *f* are from Sheppey; they are irregularly ridged all over, and may perhaps prove to be distinct; but the specimens I have seen are scarcely perfect enough for fair determination. Fig. 9, Tab. XXIV, is from Hampstead, and is considered by Mr. Edwards as a distinct species —called by him *A. filigera;* but the specimen is not in good condition, and I have placed it here as a variety for the present, though I suspect when better specimens are found they will deserve to be separated, as the ridges are very distinct and prominent. Figs. 11 *a*, *b* represent two specimens from Alum Bay, out of the bed which is there considered to be the attenuation of the London Clay. These specimens are fixed upon the matrix, and I am unable to see the interiors. In this genus, in which specimens are so very variable, even when perfect, I am unwilling to do more than consider them as varieties, and this latter I will call *A. rugata*, var. *subrugata*.

4. Astarte tenera, *J. Sowerby's MS.* Tab. XXIV, fig. 14 *a—c*.

Astarte tenera, *J. Sow.* MS., *Morris.* Catal. Brit. Foss., p. 80, 1843.
— — *Morris.* Journ. Geol. Soc., vol. viii, p. 265, pl. xvi, fig. 6, 1852.
— — *Id.* Catal. Brit. Foss., 2nd edit., p. 188, 1854.

Spec. Char. "*A. Testâ subtrigonâ, depressâ, tenerâ, inæquilaterali, concentricè, irregulariter rugosa; latere postico compressiusculo; umbonibus submedianis; lunulâ ovatâ, profundâ, lævigatâ; marginibus crenulatis.*"—*Morris.*

Shell subtrigonal, depressed, thin, inequilateral; concentrically but irregularly striated; siphonal region slightly compressed, and angulated; beaks subcentral; lunule ovate, deep, smooth; margins crenulated.

Length, $1\frac{1}{2}$ in.; *height*, $1\frac{1}{8}$ in.

Locality. Herne Bay.

The exterior of this shell in the young state is regularly ribbed or sulcated in the directions of the lines of growth, becoming smooth, or irregularly so, on the older half, giving the surface in some specimens a ridgy appearance. The shell figured by Mr. Morris is an adult individual—presumably so by its having a crenulated margin. I have not been able to see the very young condition of this species, but some specimens have the margins smooth, from which I imagine they are immature. The specific name

would rather imply that it is a tender shell; but this does not appear to be so with Mr. Edwards's specimens.

It is well known that beds of *four* different ages occur in the Cliff near Herne Bay; but all the specimens of this species that I have seen appear to have come from the Thanet Sands.

Fig. 8, Tab. XXIV, represents a specimen from a well at Hampstead, which probably belongs to this species. It is rather more ridged than the Herne Bay specimens, and it has a more elevated umbo. I have given to it the provisional name of *A. tenera* var. *Hampsteadiensis*.

5. Astarte? modicella, *S. Wood*. Tab. XXI, fig. 2 *a*, *b*.

Spec. Char. A. Testâ minimâ, ovato-subtrigonâ, compressiusculâ, lævigatâ, valdè inæquilaterali; latere postico brevissimo, obtuso, subtruncato, antico producto, obtuso; umbonibus minimis; cardine brevi, unidentato, dentibus lateralibus nullis; margine integro.

Shell small, ovately triangular, somewhat depressed, smooth externally, very inequilateral; pedal side large and obtuse; umbo small; hinge of right valve with one denticle; margins smooth.

Diameter, $\frac{1}{12}$th of an inch.

Locality. Stubbington (*Edwards*).

A single valve, as represented, is in Mr. Edwards's cabinet. It is a right valve, with its dentition somewhat like that of *Astarte* in having only one triangular and slightly diverging cardinal tooth; but it has no lateral denticle on the pedal side. In my Monograph of the Crag Mollusca are introduced several species of small bivalves, which accord with the diagnosis of *Astarte*, one of which (*triangularis*) was made the type of a new genus (as is well known) under the name *Goodallia* by Turton, who erroneously considered it as having an internal connector; and it was called *Mactra* by his predecessor Montagu; but it possesses all the characters of *Astarte*.

There are some bivalves belonging to the Eocene Period which have been figured and described by M. Deshayes under the generic name of *Goodallia* ('Desc. des An. sans vert. du Bas. de Par.,' t. i, pp. 783—786, pl. 63). These resemble in outward form and magnitude the small species of Crag bivalves to which I have referred; but they appear to exhibit a difference in the dental furniture, reversing as it were the formula of the genus *Astarte*; the right valve having two diverging teeth or denticles with a triangular cavity between them, into which a large triangular tooth is inserted from the left valve (that is, according to the representations), contrary to what it is in *Astarte*, where the large triangular tooth is in the right valve, and the two diverging teeth in the left. It is expressly stated in the diagnosis of *Goodallia* by Deshayes, that the margins are invariably smooth. "Les bords sont simple sans aucune trace de dentalures;" p. 782.

If this diagnosis be adhered to, it is obvious that the living shell (*Mactra triangularis*) which M. Deshayes has taken for the type of the new genus *Goodallia* must be discarded from it, as it has a strongly denticulated margin.

Goodallia of Turton has by general assent been suppressed as untenable, and the resuscitation of the name by M. Deshayes will be at the expense of some confusion. If that name be admitted, it must stand upon its own merits wholly irrespective of Turton or of the *triangularis*, and upon the reversion of the dental formula. Should that be constant, it may be considered a generic distinction; and in these older Tertiary shells of M. Deshayes, as well as the shell under consideration, there appears to be an absence of the lateral tooth which is present in all the small species of true *Astarte*.

These shells of M. Deshayes seem to be the only representatives of our present genus in the Paris Basin.

WOODIA. *Deshayes*, 1858.

Generic Character. "*Testa subrotunda, æquivalvis, æquilateralis, clausa, lævigata vel excentricè striata; marginibus obliquè crenulatis. Cardo crassiusculus, in valvula dextra unidentatus; dente magno, triangulari, mediano; in medio subcanaliculatus, in valvula sinistra bidentatus; dentibus inæqualibus divaricatis; aliquantisper dentibus lateralibus obsoletis. Nymphæ minimæ depressæ, ligamentum minimum externum ferentes. Cicatriculæ musculares minimæ, æquales, ovatæ vel subrotundæ. Linea pallealis simplex.*"—*Deshayes.*

M. Deshayes has proposed the above name as generic for the reception of some species of shells of which he considers *Tellina digitaria*, Linn., to be the type. In my Monograph of the Crag Mollusca this shell is described under the name of *Astarte*, as I thought it merely an aberrant form of that genus; and although I feel complimented by the intention of that able conchologist, I am not now convinced that the differences between it and *Astarte* are sufficient to constitute a generic separation. I thought it possible that, when the animal of the Mediterranean shell became known, it might present some peculiar distinction; but I doubted whether the shell itself would justify a generic removal.

There are three species from the Paris Basin, figured by M. Deshayes under the above generic name, which cannot fairly be included in the genus *Astarte*, and also one from our English Lower Tertiaries, for which I have been obliged to adopt the name of *Woodia*. These older Tertiary fossils not only differ from the genus *Astarte*, but they appear to me to differ from the generic character pertaining to *Tellina digitaria*, Linn. In this latter shell the connector is placed wholly upon the exterior on a prominent fulcrum; but in the present fossils from the older Tertiaries the ligament is situated in a linear depression within the dorsal margin, although it probably acted in a ligamental manner over

a fulcrum. The dentition, also, in *digitaria* is different, there being in the right valve of that shell one cardinal obtuse and truly triangular tooth, and two elongated and distinct and distant lateral teeth, with a similar arrangement of denticles in the left or opposite valve, so that the prominent parts of the hinge of the one interlock into the corresponding depression of the other; but in the Eocene shells there are no lateral teeth, only one large bifid or diverging cardinal tooth—or, I ought rather to say, they are two distinct diverging teeth in the right valve beneath the umbo. There are no oblique markings upon the exterior of the older Tertiary shells—only crenulations upon the inner margins of the valves, which diverge or run out in opposite directions; but in *digitaria* those oblique markings are wholly confined to the outer layer of the shell, and are not impressed upon the inner margin,—corresponding in that respect with those species of *Astarte* in which the exterior is ornamented with oblique ridges.

In the 'Journ. de Conch.,' vol. x, p. 141, M. O. Semper has enumerated nine species as belonging to this genus; and these he has divided into three groups, viz., 1st, espèces striés, four species; 2ndly, espèces lisses, four species; and 3rdly, espèces inéquilatérales, surface striée où treillissée. With the exception of *digitaria*, Linn., they are all fossil.

1. Woodia crenulata? *Deshayes.* Tab. XXV, fig. 11.

Woodia crenulata (?), *Desh.* An. sans Vert. du Bass. de Par., t. i, p. 792, pl. lix, figs. 9—11, 1860.

Spec. Char. "*W. Testâ minima, orbiculari, solidula, convexiuscula, lævigata, subæquilaterali; umbonibus tumidulis, oppositis; marginibus lateralibus latè et oblique crenulatis, margine inferiore tenuissime crenulato, dente cardinali unico in valvula dextra postice elongato; dentibus duobus in valvulâ sinistrâ subæqualibus.*"—*Deshayes.*

Shell small, orbicular, strong, slightly convex, smooth, nearly equilateral; umbones slightly prominent, inner margins broadly and obliquely crenulated; one cardinal tooth in the right valve, and two diverging teeth in the left.

Diameter, $\frac{1}{8}$th of an inch.

Locality. Barton (*Edwards*).

A single specimen of this genus is all that I have seen from the English Lower Tertiaries; it is in Mr. Edwards's cabinet, and it has affixed to it the MS. name of *W. orbicularis*, from which I presume that gentleman considers it to differ from the French shell. I feel unwilling, however, to found a new species upon the minor differences here presented; and it will require a comparison with the type specimen of M. Deshayes before a separation could be justified, and this I am not able to make. Our specimen is the right valve, and the cardinal "bifid denticule" is, in fact, composed of two teeth, diverging from beneath the umbo at an angle of 75°. These teeth are of unequal size and length, with a distinct separation between them: there are no lateral

teeth. The crenulations on the margin are broad on each side, and diverge in nearly the same direction. They are confined to the inner and lateral margins, and do not extend to the outer layer of the shell, with which they are, apparently, unconnected.

CRASSATELLA. *Lamarck*, 1799.

TELLINA (sp.), *Solander.*
MACTRA (sp.), *Brug.*
PTYCHOMYA (sp.), *Agass.*
PAPHIA, *Roissy*, 1805.
GOULDIA, *C. B. Adams.*

Generic Character.—Shell thick and strong, transverse, occasionally sub-orbicular or triangular, closed; inequilateral, smooth, or covered with raised striæ, imbrications, or ridges (thickened lines of growth); lunule distinct; hinge with two cardinal diverging teeth. Connexus cartilaginous, placed in a triangular fossette; lateral teeth often obsolete; adductor muscles deeply impressed; pedal muscle-mark distinct; palleal impression entire.

Animal with the mantle lobes open or only united by the branchial septum; foot of moderate size, compressed and grooved.

This genus appears to be nearly related to *Astarte*, and, in like manner, most of the species have the inner margins of the valves covered with crenulations, but I cannot say that such differences constitute a mark of distinction between the young and aged. These crenulations are confined to the inner portion of the shell, and they appear to be smaller and finer in the young, as if the fimbriæ of the mantle were of the same number at all ages. Beneath the surface on some of the species (perhaps all) the shell is covered with radiating striæ. I am not able to say if the crenulations upon the margin be the outcrop of these rays, but I presume they are produced by a more or less fimbriated margin of the mantle.

The shells of this genus are not only thick and strong, but they are capable of being very firmly closed by powerful adductor muscles, which leave a deep impression in the interior, and they are furthermore secured from lateral motion by prominent denticles, which are sometimes ridged at right angles to their position, corresponding in that respect to some species of *Astarte*.

There is great variation in magnitude in the species of this genus. *Crassatella plumbea*, a shell common to the Paris Basin, but which, I believe, has not yet been found in this country, is of great thickness; a single valve weighs half a pound. Some American fossil species have a length of six inches; others, on the contrary, are very diminutive. The genus is abundant in species in the Lower Tertiaries of this country, but it has not,

to my knowledge, been found in the Upper, although by no means rare in America in beds supposed to be of the age of our Coralline Crag.

As a recent genus it is widely distributed, but principally confined to tropical or sub-tropical regions.

The triangular species were erected into a genus by C. B. Adams, in 1845, under the name *Thetis*, but afterwards changed into *Gouldia*.

In this genus and in *Cardita* a great variety of forms will be seen in specimens from the Lower Tertiaries of this country, as also in France. Some of those which I have admitted to the rank of species may, perhaps, be considered by some Palæontologists as only entitled to the position of varieties. Whatever may be their claim in that respect, they will at least show well-marked distinctions in form and sculpture; and it is not, I conceive, a matter of much importance, geologically speaking, whether they be called varieties or species, as they will in either case afford a measure for a palæontological comparison of Faunas.

The line of separation between species and varieties is in our present knowledge most arbitrary, some authors sweeping into a single species a number of well-marked forms previously regarded as distinct; while others, or even the same authors, are erecting into specific importance forms not more, and often even less, distinct from each other than those thus swept into a single species.

The most rational course, as it seems to me, will be to assign specific value to all those forms which in any given deposit maintain constant characters, and do not by transition pass into others *occurring in the same deposit*. If, in the progress of research into existing Natural History, or into Palæontology, any of these should be found to pass *geographically* into each other, the soundness of their original separation would not be materially impaired, because it would be evident that, notwithstanding this geographical transition, the several races possessed that impress of permanency which caused them to maintain their distinct characters while living together in the same area, or under the same conditions; and what other than this can be said in justification of the separation of any nearly allied species? When a general repugnance between the respective sexes of any two groups of organisms living together becomes established, then, in my opinion, specific division is accomplished; for we have the existence of that state of things established which must preclude an intermingling of the races, and offer ready objects for the diverging action of external conditions upon living organisms.

With these views I must, of course, always feel that there is great uncertainty attaching to many of the specific identities which I have made of new forms nearly allied to some previously known one, whenever the specimen upon which such new form is founded is either unique or very rare, but when a suite of specimens wherein the characteristic peculiarities of either form are available for examination then the specific values attached seem to me more reliable. For this reason many of the forms to which I have attached the species-value, or have restricted to varieties, may be found hereafter to be incapable of being sustained in that category.

1. Crassatella Bartonensis, *Edwards* MS. Pl. XXIV, fig. 7 *a*, *b*.

Spec. Char. Cr. Testâ orbiculato-trigonulâ, crassiusculâ, subæquilaterali, compressâ; regulariter sulcatâ vel lamellatâ; lamellis distantibus, simplicibus; umbonibus acutis elevatis; pedi-regione vix minore; ani regione supernè declivi; lunulâ minimâ, depressâ, lævigatâ; cardine brevi; in valvâ dextrâ unidentato, valvâ sinistrâ bidentato; dentibus lateralibus elongatis; marginibus integris.

Shell roundedly trigonular, not very thick, nearly equilateral, compressed, externally sulcated or laminated; ridges distant, rounded and depressed; beaks sharp and prominent; pedal region a trifle the smaller of the two; dorsal margin sloping; lunule small, depressed, elongated; hinge short, denticles sharp; lateral teeth narrow, elongated; margin smooth.

Diameter, $\frac{5}{8}$ths of an inch.

Locality. Barton (*Edwards*).

Two specimens of this species are all that I have seen, and they are both from the same locality. The principal distinction is the exterior ornament, the ridges or lamellæ being more distant than on any other of the suborbicular species of this genus. These ridges are very regular and cover the entire surface. The diagonal ridge on the siphonal or anal side, so conspicuous on the transverse species, is scarcely perceptible.

2. Crassatella Bronnii (?), *Merian*. Pl. XXIV, fig. 2 *a*—*c*.

Crassatella Bronnii, *Merian*. In Litteris Sandb., 1853, sec. Deshayes.
— — *Desh.* An. sans Vert. du Bass. de Par., vol. i, pl. xix, figs. 12—14, and pl. xx, figs. 22—24, 1860.

Spec. Char. Cr. Testâ minimâ, ovato-trigonâ, inæquilaterali, transversim sulcatâ; umbonibus minimis, acutis, proeminentibus; latere antico breviore; postico subtruncato, lunulâ minimâ, depressâ, lævigatâ, ovato-lanceolatâ; cardine brevi, bidentato, altera unidentato, dentibus angustis, elongatis; marginibus integris.

Shell small, roundedly trigonal, slightly inequilateral, covered with regular and rather close-set concentric ridges; beaks small and somewhat prominent, sides unequally rounded; lunule small, smooth and ovately elongate; hinge narrow, one tooth in the right valve and two in the other; margins smooth.

Diameter, $\frac{1}{2}$ an inch.

Localities. Highcliff, Barton, Stubbington (*Edwards*).
France: Jeures, Etrèchy (*Deshayes*).

Though this species is said to be rare in France, it does not appear to be so in England; it seems to have taken the place of *Cr. trigonata;* this latter, although so abundant there, has not, to my knowledge, been found in England. Our present shell resembles *trigonata* in some respects, but it is, I think, distinct.

There are some specimens in Mr. Edwards's collection, to which he has given the MS. names of *Cr. æqualis* (fig. 4) and *Cr. tumescens* (fig. 5), which so closely resemble *Cr. Bronnii* that I have considered them only as varieties.

M. Deshayes describes his shell as "marginibus tenui-crenulatis." Our specimens have the margins smooth, as have all our triangular Eocene species.

3. Crassatella corbuloides, *Edwards* MS. Pl. XXIV, fig. 3.

Spec. Char. Cr. Testâ minutâ, ovato-trigonulâ, inæquilaterali, convexiusculâ; concentricè sulcatâ, sulcis distantibus; umbonibus elevatis, acutis, prominentibus; pedi-regione minore et breviore; supernè depressâ; siphoni-regione majore, margine convexâ; lunulâ parvâ, depressâ, lævigatâ; marginibus integris.

Shell small, ovately triangular, inequilateral, slightly convex, covered with ridges or periodical thickenings of growth, rather distant; beaks prominent, and sharp; pedal region small, rounded, and somewhat depressed; the other side larger, and convex; lunule small, smooth, and rather deep; margins smooth.

Diameter, $\frac{3}{8}$ths of an inch.

Locality. Stubbington (*Edwards*).

One specimen is in Mr. Edwards's cabinet with the above name, which I have here adopted, as it appears to differ from *Cr. Bronnii* in being more elevated, and the ridges with which it is covered are fewer and more distant. The nearest approach to this shell that I know is a recent Mediterranean species figured and described by H. Adams under the name *Gouldia modesta;* but that has a denticulated margin, and is otherwise distinct.

4. Crassatella compressa, *Lamarck.* Pl. XXIII, fig. 5 *a*, *b*.

Crassatella compressa, *Lam.* (non *Sowerby*). An. du Mus., vol. vi, p. 410, No. 4, and vol. ix, pl. xx, fig. 5 *a*, *b*, 1806.
— — *Desh.* Coq. Foss. des Env. de Par., vol. i, p. 37, pl. iii, figs. 8, 9, 1824.
— — *Id.* An. sans Vert. du Bass. de Par., vol. i, p. 744, pl. xx, figs. 9—11, 1860.

Spec. Char. C. Testâ transversâ, subtriangulari, compressâ, inæquilaterali; tenuiter sulcatoplicatâ; pedi-regione obtusè truncatâ, ano subsinuoso; umbonibus minimis, acutis, non-

prominentibus; lunulâ elongato-lanceolatâ, profundâ; ano angusto, elongato; cardine incrassato, unidentato, alterâ bidentato; dentibus obsoletè sulcatis; marginibus tenuiter crenulatis.

Shell transversely or ovately triangular, compressed, slightly inequilateral, finely and regularly sulcated; pedi-lateral margin obtuse and rounded; opposite side angulated and obscurely sinuated; beaks small; lunule deep and elongated; corselet large and lanceolate; hinge broad and thick; teeth obsoletely sulcated; margins finely crenulated.

Length, 1 inch; *height*, $\frac{6}{8}$ths of an inch.

Localities. Huntingbridge (*Edwards*).

France: Grignon, &c., Calcaire grossier (*Deshayes*).

In 'Les Coq. foss. des Env. de Par.' M. Deshayes has given three varieties to the above name, and in the supplement to that work he has elevated one of them to the rank of a species. The same differences appear to exist in specimens from our own deposits; and as they seem much more abundant in the Paris Basin I imagine that M. Deshayes may have better materials for determination than we have. The present shell is distinguished by the lamellæ or ridges, which are numerous, prominent, and cover the entire surface. These are obtuse; the interspaces are about the same width as the ridges. The shell is slightly inequilateral, the siphonal side being a little the longer, pointed and less deep; the pedal side is shorter and higher, so that one side is not much larger than the other. In perfect specimens the ridges are carried over the flattened anal area, and the crenulations extend over the entire edge of the inner margin, except the truncated portion of the siphoni-lateral side.

Fig. 1, Pl. XXIII, represents a specimen from Mr. Edwards's Collection which has the MS. specific name of *hemileia*, but which, I think, is not specifically distinct. I have, therefore, united it as a variety under that name. It differs principally in being sulcated only over the umbonal region. This variety is from Brook and White Cliff Bay.

5. Crassatella gibbosula, *Deshayes*. Pl. XXIII, fig. 15 *a—c*.

Crassatella gibbosula, *Desh.* Coq. Foss. des Env. de Par., vol. i, p. 37, pl. v, figs. 5, 6, 7, 1824.

Spec. Char. "*C. Testâ ovatâ, tumido-gibbosâ (?); angulo antico eminentissimo; lamellis transversis exiguis prominentibus, et posticè tuberculo minimo seriatim interceptis; lunulâ profundè lanceolatâ.*"—*Deshayes.*

Shell elongate, transversely subquadrangular, or irregularly trapezoidal; very inequilateral; pedal side rounded; siphonal side produced, angular, and slightly pointed; lamellæ sharp, prominent, and distant; lunule distinct.

Length, $1\frac{7}{8}$ths inch; *height*, $1\frac{1}{8}$th inch.

Locality. Bracklesham Bay (*Fisher*).

France: Grignon, Courtagnon, Chaumont (*Deshayes*).

A single specimen is all that I have seen. It enriches the cabinet of, and was found by, the Rev. O. Fisher. The English specimen is the right valve, and it differs somewhat from the figure and description of the French shell, especially so from some specimens I have from Chaumont, which are much more gibbous or tumid, and broader or higher on the siphonal side. Our shell is also more rounded on the pedilateral margin than the French specimens. I feel unwilling to propose a new name, but, if some more specimens should confirm the great differences between the English fossils and those from France as being specific, I would call it *C. Fisheri*. M. Deshayes has figured a shell which he has called *C. distincta*. This is flatter than *gibbosula*, and it has fewer and smaller ridges than those upon our specimen, which appears of an intermediate character. This species is given from the nummulitic deposit in the province of Barcelona by M. Alex. Vezian, 'Bull. de la Soc. Géol. de Fr.', 2nd series, vol. xiv, p. 337.

6. Crassatella Grignonensis, *Deshayes*. Pl. XXIII, fig. 8 *a*, *b*.

Crassatella Grignonensis, *Desh.* An. sans Vert. du Bass. de Par., p. 748, pl. xx, figs. 3—5, 1860.

— compressa, var., *J. Sow.* In Dixon's Geol. of Sussex, p. 88, pl. xi, fig. 21, 1850.

Spec. Char. C. "*Testâ transversâ, ovato-trigonâ, inæquilaterali; antice obtusâ; posterius oblique truncatâ, angulo obtuso, inæqualiter bipartitâ transversim tenue et regulariter sulcatâ, sulcis adlatus posticum evanescentibus; umbonibus minimis, acutis, depressis, proeminentibus; lunulâ angustissima profundâ; ano depresso, lævigato, lanceolato; cardine angusto; dentibus minimis angustis simplicibus; marginibus in medio tenuissime crenulatis.*"—*Deshayes.*

Shell transverse, ovately triangular, or rather irregularly oblong, inequilateral; pedal side short and rounded; siphonal side produced, obtusely angulated; exterior with numerous and fine ridges, less distinct on the anal region, or side beyond the angular slope; beaks small, depressed; lunule elongate and narrow; margins finely crenulated in the middle, smooth at the sides; cardinal tooth serrated.

Length, $\frac{7}{8}$ths of an inch; *height*, $\frac{5}{8}$ths of an inch.

Localities. Bracklesham Bay (*Edwards*).

France: Grignon, Parnes, Calc. gross. (*Deshayes*).

Not having the French specimens to compare with, I have placed the English fossil as an identity, depending upon figures and descriptions above referred to. Fig. 10 is, I think, a variety of this species, which may be called *Anglica*. It much resembles, and at one time I thought it identical with, *Cr. donacialis*, Desh., but it appears to differ in form, and

the exterior is more finely ridged over the centre, but the anal ridge beyond the siphonal slope is naked.

Fig. 12, Pl. XXIV, represents a shell from Bracklesham, called by Mr. Edwards *planiuscula*. This is more elongated, more inequilateral, and more compressed, and covered with finer and sharper ridges. When more specimens are found it may probably prove to be distinct. For the present I have inserted it here as a variety.

7. Crassatella plicata, *J. Sowerby*. Pl. XXIII, fig. 14 *a*, *b*.

Crassatella plicata, *J. Sow.* Min. Conch., pl. 345, fig. 2, 1822.
— — *Nyst.* Coq. Foss. de Belg., p. 85, pl. xli, fig. 3, 1843.

Spec. Char. Cr. Testâ transversâ, elongato-trigonâ, inæquilaterali, compressiusculâ; pedi-regione altiore; alterâ elongatâ et truncatâ; extùs sulcatâ, sulcis posticis evanescentibus; umbonibus minimis acutis, depressiusculis; lunulâ ovatâ, profundâ; siphoni-regione depresso, lanceolato; cardine angusto; dentibus parvis, simplicibus; marginibus in medio tenuiter crenulatis.

Shell transverse, elongately trigonal, inequilateral, somewhat compressed; pedal region the higher; siphonal side produced and truncated, covered externally with concentric ridges, which become obsolete over the anal region, where it is nearly smooth; hinge rather narrow, and inner margin crenulated in the middle.

Length, $\frac{1}{2}$ an inch; *height*, $\frac{3}{8}$ths of an inch.

Localities. Bracklesham and Barton (*Edwards*); Southampton (*J. Sow.*).

This was originally separated from *sulcata* by Mr. J. Sowerby, and I have retained it as a distinct species. M. Deshayes has given this name as a synonym to *Grignonensis*; but the shells appear to be specifically distinct. Our present species is more finely ridged; it is shorter and rather more rounded in outline, with the siphonal region less angular.

A small specimen, which, I think, must belong to this species, has very recently been found by Mr. Alfred Bell in the modern deposit at Selsey, called the "Mud-bed." This is, in all probability, a specimen washed out of the contiguous Eocene Formation. It much resembles our present species, more so than any other known to me, but the ridges upon the umbonal region are fewer and more distant than on the body of the shell, contrary to the general character of the exterior ornament in this genus.

8. Crassatella pumilio, *S. Wood.* Pl. XXIV, fig. 1.

Spec. Char. C. Testâ minutissimâ, rotundato-trigonulâ; subinæquilaterali; umbonibus acutis, prominentibus; lunulâ minimâ, depressâ, ovatâ; cardine brevi, in valvulâ dextrâ bidentato, in alterâ unidentato; dentibus lateralibus, elongatis; marginibus integris.

Shell very small, roundedly triangular, slightly inequilateral; beaks sharp and rather prominent; lunule small, ovate, and depressed; hinge short, with two cardinal teeth in the left valve and one in the right; lateral teeth narrow, elongated; margin smooth.

Diameter, $\frac{1}{16}$th of an inch.

Locality. Highcliff, Barton (*Edwards*).

Two small specimens exhibiting the interiors of the opposing valves are among the shells kindly sent to me for examination and description by Mr. Edwards, and the card to which they are attached has on it the name of *Goodallia trigona*, but I think the arrangement of the dental furniture corresponds better with the genus in which I have here temporarily placed them. The connector appears to have been cartilaginous or internal. The specific name of *trigona* is preoccupied in this genus, and the above one which I have proposed is more expressive of its diminutive character. It may possibly be the young state of *Cr. Bartonensis* or some other triangularly formed species, and its present name is merely provisional.

9. Crassatella sinuosa (?), *Lamarck.* Pl. XXIII, figs. 3 and 9.

Crassatella sinuosa (?), *Desh.* Coq. Foss. des Env. de Par., vol. i, p. 39, pl. v, figs. 8, 9, 10, 1824.

Spec. Char. Cr. "Testa ovato-inflatâ anticè (?) angulatâ, sinuatâ, sulcis numerosis irregularibus, lævibus; margine crenato; lunulâ profundâ ovatâ."—Deshayes.

Shell ovately triangular, thick, strong, inequilateral; pedi-lateral margin rounded, the opposite side angulated, truncated, subsinuated; pedal region covered with depressed and rather irregular ridges, the other half of the shell nearly smooth, with an obtuse diagonal ridge on the siphonal side, beyond or above which the shell is flattish, with rough lines of growth; hinge thick and broad; margins crenulated.

Length, $1\frac{1}{2}$ inch; *height*, $1\frac{3}{16}$ths inch.

Localities. Barton and Bracklesham (*Edwards*).

France: Chaumont, Calc. gross. (*Deshayes*).

There are two specimens in Mr. Edwards's cabinet which appear to correspond with the French shell, but to which I have put a mark of doubt, one from each of the above-named localities. The shell in France is, I believe, not rare, and is subject to consider-

able variation. M. Deshayes says ('An. sans Vert. du Bass. de Par.,' p. 741), "La sinuosité du bord ventral, d'apres laquelle nous avons choisi le nom specifique, ne se presente que dans le plus petit nombre des individus." I have, therefore, upon that report, permitted the British fossil to stand doubtfully with the above name. Our shell does not exhibit a marginal sinuosity, but in other respects it seems to correspond.

10. Crassatella Sowerbyi, *Edwards* MS. Pl. XXIII, fig. 6 *a*, *b*.

Crassatella compressa, *J. Sowerby* (non *Lam.*). In Dixon's Geol. of Sussex, p. 88, pl. ii, fig. 2, 1850.

Spec. Char. Cr. Testâ transversâ, irregulariter triangulari, crassâ, compressiusculâ, inæquilaterali, sublævigatâ, aut ad umbonem sulcis paucis distantibus; pedi-regione ad marginem convexâ, alterâ majore productâ, angulatâ et truncatâ; umbonibus depressis; lunulâ elongato-lanceolatâ; cardine incrassato, unidentato in valvâ dextrâ, in alterâ bidentato; marginibus in medio crenulatis.

Shell transverse, irregularly triangular, thick, rather compressed, inequilateral, sulcated in the umbonal region, smooth on the outer or older part of the shell; pedal margin rounded; siphonal side angulated and truncated; beaks rather depressed and obtuse; lunule elongate, not very deep; hinge thick, one tooth in right valve, and two in the left; ventral margins crenulated in the middle.

Length, $1\frac{1}{8}$th inch; *height*, $\frac{6}{8}$ths of an inch.

Localities. Bracklesham, Stubbington, White Cliff Bay (*Edwards*).

Mr. Edwards has separated this from *compressa* of Lamarck, in which I agree with him. It somewhat resembles the variety called *hemileia*, but it is distinguished by being constantly more free from ridges and more compressed. Fig. 13 of the same Plate represents a specimen which has had the MS. name of *Hantoniensis* affixed to it by Mr. Edwards. In Pl. XXIV I have also had represented two other forms, to which have been affixed the respective names of *C. semi-lævis* (fig. 15) and *C. obesa* (fig. 16 *a*, *b*). The first of these two is from Bracklesham; it varies in shape in being more elongated, and it has finer ridges over the umbonal region. The other is from Stubbington; it is shorter and more tumid. These have all been considered by Mr. Edwards as specifically distinct, and possibly they may be so, but for the present I regard them as varieties.

11. Crassatella subquadrata, *Edwards*. Pl. XXIII, fig. 12.

Spec. Char. Cr. Testâ transversâ, subquadrangulatâ, tumidâ, lævisculâ, inæquilaterali; pedi-regione minore; alterâ truncatâ vel subquadratâ; umbonibus obtusis, elevatis; siphoni-

regione obtusè angulatâ; cardine angusto; dentibus mediocris; lunulâ elongatâ non valdè depressâ; marginibus crenulatis.

Shell transverse, irregularly quadrangular, tumid or inflated, smooth in part, inequilateral; pedal region the smaller; siphonal side subquadrilateral or truncated; beaks obtuse, somewhat elevated; hinge narrow, with moderate-sized denticles; lunule elongated, slightly depressed; margins crenulated.

Length, $\frac{5}{8}$ths of an inch; *height*, $\frac{4}{8}$ths of an inch.

Localities. (var. *a*) White Cliff Bay, Isle of Wight, (var. *b*) Barton. *Edwards.*

This appears to be a rare shell. I have seen only one specimen from each locality. That from Barton is the more perfect, and shows broad ridges in the umbonal region, but they do not extend over the anal area or beyond the obtuse ridge which divides diagonally the siphonal side. The other, from White Cliff Bay, has lost its outer coating, showing a coarse and fibrous structure, from which, I presume, the inner margin is denticulated, although the inside is hidden by the matrix. This in form and appearance has the aspect of *Astarte*, but the connector is internal.

12. Crassatella sulcata, *Solander*. Pl. XXIII, fig. 11 *a—c*.

Tellina sulcata, *Solander* (in *Brander*). Fossilia Hantoniensia, pl. vii, fig. 89, 1 776.
Crassatella sulcata, *J. Sowerby*. Min. Conch., pl. 345, fig. 1, 1822.
— — *Desh.* An. sans Vert. du Bass. de Par., vol. i, p. 747, pl. xx, figs. 12—14, 1860.

Spec. Char. C. Testâ elongato-trigonulâ, valdè inæquilaterali, convexâ, tumidiusculâ; siphoni-regione angulatâ, transversim sulcatâ; sulcis profundis; lunulâ ovatâ; cardine angusto, inæqualiter bidentato; dentibus lateralibus angustis, elongatis; marginibus crenulatis.

Shell elongately trigonal, very inequilateral, slightly convex, rather thick; siphonilateral margin angulated, transversely or concentrically sulcated; furrows deep, with elevated ridges between them; lunule acutely ovate; hinge rather narrow, with unequal denticles, two in each valve; lateral teeth elongated; margins with fine crenulations.

Length, $1\frac{3}{8}$ths inch; *height*, 1 inch.

Locality. Barton; (var. *gradata*) Huntingbridge.
France: Senlis, Pontoise, Valmondois, &c., Sables moyens (*Desh.*).
Province of Barcelona (*Vézian*).

This is one of the most abundant shells at Barton, where the two valves have been often found united; traces of the epidermis may be observed, but I have not seen the connector. There is much variation in regard to proportional dimensions, some individuals being very short and high comparatively, while others are much elongated; some of Mr. Edwards' specimens, of which I have had one figured (Pl. XXIII, fig. 7 *a*, *b*), are

very abnormal, the length measuring nearly twice the height; these he has called *Cr. ensiformis*, with a mark of doubt against this specific name. I think they are only deviations from the more common type, as I can find no other difference than length, and almost every intermediate form may be observed. The anal area, or that flat space beyond the diagonal ridge, is divided into two unequal parts, produced, I presume, by the division or septum of the syphons.

This species is said by M. Deshayes not to be abundant in the Paris Basin, where it does not attain to so large a size. Some of our specimens show a little erosion at the umbones, while others are there quite perfect.

There is another shell of Mr. Edwards's marked as "*Cr. rostralis?*" which I have also had figured (Pl. XXIII, fig. 4 *a*, *b*), but which, I think, is scarcely entitled to specific isolation; it is narrow at the siphonal termination; it is, however, said to be always smaller and more compressed, with a less curve to the basal margin, and the external ridges rather narrower. I propose to call it var. *gradata*, as *rostralis* is another species. *Crassatella sulcata*, Sow., is a name given in a list of species from the Nummulitic deposit in the Province of Barcelona, by M. Alex. Vézian ('Bull. de la Soc. Géol. de France,' 2nd ser., vol. xiv, p. 387), but it does not appear to be admitted by M. Deshayes.

13. Crassatella tenuisulcata, *Edwards* MS. Pl. XXIII, fig. 2 *a*, *b*.

Spec. Char. C. Testâ transversâ, elongatâ, tumidâ, tenui-sulcatâ, sulcis numerosis ad regionem ani evanentioribus; valdè inæquilaterali, crassâ; pedi-regione convexâ siphoni-regione majore productâ, elongatâ, margine dorsali depressâ, concaviusculâ; umbonibus elevatis obtusis; lunulâ depressâ; marginibus crenulatis.

Shell transverse, elongate, tumid, covered externally with numerous and rather fine ridges, except over the anal region or above the diagonal ridge, where it is nearly smooth, or with numerous visible lines of growth. Siphonal side the larger, narrow and truncated; umbones rather prominent and obtuse; lunule depressed; ventral margins crenulated.

Length, $1\frac{1}{8}$th inch; *height*, $\frac{11}{16}$ths of an inch.

Locality. Barton (*Edwards*).

This is not rare, and the two valves are often found united. It differs from *C. sulcata* in the exterior ornament, which is not so coarse, and the siphonal or anal side is more produced, and the dorsal margin on that side is depressed. The finer sulci terminate at the angle formed by the diagonal ridge. The nearest approach to this species appears to be *C. donacialis*, Desh., but that shell is more equilateral, and it wants the carinated edge of this species. Another shell, called *lineatissima*, from Bramshaw and Brook (Pl. XXIV, fig. 6 *a*, *b*), is, I think, a variety of this species.

CHAMA. *Pliny, Linné, &c.*

Generic Character. Shell thick, strong, and adherent; irregular, rugose or foliated; inequivalved, subequilateral, with a somewhat involute umbo. Hinge with two teeth in one valve, and one in the opposite inserted between them; margins sometimes crenulated. Impressions by the adductors large and elongately oval; mantle-mark without a sinus; connexus ligamental.

Animal with the mantle margins united and the edges fringed; siphonal tubes short and large, not extending beyond the shell; branchial one fringed; foot short and bent.

The exterior of the shells of this genus in the recent state is more or less ornamented with spines, or otherwise elegantly fringed, and they are generally much coloured. The spines are sharp, pointed, subtubulous and fimbriated, or sometimes broad and spatulate. In fossils the shells are covered with rugosities or spinous fimbriæ, and are more or less radiated between them. Our Eocene species appear to have been attached by the left valve. *Chama gryphoides* of the Crag adhered by the right, and the recent species vary in this respect.

This is a pretty well-marked genus, and its nearest relative is *Diceras*, from which it has probably descended. In that genus the valves are more involute, and where may be seen the external connector retreating in a groove up the spire as the shell increases and the umbo recedes. The same is visible, in a minor degree, in some specimens of our present genus, where the shell has adhered only by the umbo. The valves are generally unequal, and occasionally there is no mark of adherence on either valve; at others the animal has attached itself by the greater part of the surface of the lower valve. In some of the species the inner surface of the shell is finely punctured in a regular manner, from the peculiar composition of the shell.

This genus is considered to indicate tropical or subtropical conditions, not extending northwards beyond the Mediterranean, and the animals live chiefly among coral-reefs. I am not aware of their having been found fossil lower than the older Tertiaries; and, until lately, have they been known only in the middle series of that period.

1. Chama calcarata, *Lamarck.* Pl. XXV, fig. 1 *a—c.*

Chama calcarata, *Lam.* Ann. du Mus., vol. xiv, pl. xxiii, figs. 4 *a*, *b*.
— — *Desh.* Coq. Foss. des Env. de Par., p. 246, pl. xxxviii, figs. 5—7, 1825.

Spec. Char. "*C. Testâ orbiculatâ, turgidâ, plicis transversis acutis distantibus; superioribus spinis prælongis, canaliculatis, radiatim echinatis.*"—*Deshayes.*

Shell irregularly orbicular, thick, and strong, covered by prominent sharp, reflected,

and somewhat distant imbrications, with oftentimes elongated and sometimes tubular spinous processes; outer surface covered with radiations, inner margins smooth; mark of attachment variable.

Diameter, $1\frac{1}{4}$ inch.

Localities. Bracklesham Bay (*Edwards*).

France: Parnes, Chaumont, Grignon, Calc. gross. moyen et sup. (*Deshayes*).

Sinde (*Deshayes*).

The name of *punctata* was proposed for this species by M. D'Orbigny as one of prior date, but the shell to which this name was given by Bruguière is a species now living in the sea near Guadaloupe, as stated by M. Deshayes, and is quite distinct, in which opinion I coincide. Lamarck, therefore, appears to have been the first to describe the present fossil, and the above name has been generally employed. The inside lining of the shell is deeply and regularly punctulated, looking like the encrustation of Polyzoa, but this is not visible on the impressions of the adductor muscles. This is strongly marked; and the two valves are very differently ornamented. The principal characters are the long spinous fringes and the large radiating ridges between the laminæ upon the right or upper valve; between the distant laminæ of the lower valve the shell is ornamented with granules arranged in a somewhat zigzag manner, very visible in perfect specimens from Grignon, but indistinct upon the only individual of this lower valve that I have seen from our own beds. The shell is attached by the left valve, and the mark of adherence is generally small, as shown by the French specimens.

This is a rare shell in our English beds.

2. Chama fimbriata (?) *Defrance*. Pl. XXV, fig. 8.

Chama fimbriata, *Defrance*. Dict. des Sci. Nat., vol. vi, Suppl., p. 65, No. 3, 1818.
— — *Desh*. An. sans Vert. du Bass. de Par., vol. i, p. 584, pl. lviii, figs. 23—25, 1860.
— ponderosa, *Id*. Coq. Foss. des Env. de Par., vol. i, p. 248, pl. xxxvii, figs. 9, 10, 1825.

Spec. Char. Ch. "*Testâ orbiculatâ, incrassatâ, irregulari, convexâ, multilamellatâ, intùs lævigatâ; lamellis valvæ inferioris brevibus, simplicibus; valvæ superioris longioribus, laceris, plicatis; dente cardinale magno valdè sulcato.*"—*Deshayes.*

Shell orbicular, thick, irregular, convex, and covered with numerous and close-set lamellæ; inside smooth; reflected ridges close and numerous.

Diameter, 2 inches.

Localities. Bramshaw (*Edwards*).

France: Auvers, Valmondois, &c., Sables moyens (*Deshayes*).

An aged specimen in Mr. Edwards's cabinet appears to correspond with the one figured by M. Deshayes, as above referred to. It is covered with very close-set fimbriæ, which appear to be its principal distinction. The radiating lines are nearly obliterated by the numerous ridges, and from its thickness the valve has afforded a retreat for a *Gastrochæna*. Our specimen is the upper or right valve.

3. Chama gigas, *Deshayes*. Pl. XXV, fig. 2.

Chama gigas, *Desh.* Coq. Foss. des Env. de Par., vol. i, p. 245, pl. xxxvii, figs. 5, 6, 1825.
— — *J. Sow.* In Dixon's Geol. of Suss., p. 93, pl. ii, fig. 96, and pl. iii, fig. 26, 1850.
— — *Desh.* An. sans Vert. du Bass. de Par., vol. i, p. 581, 1858.

Spec. Char. "*C. Testâ ovato-rotundatâ, gibbosâ, crassâ, foliaceâ, lævigatâ; lamellis numerosis, concentricis, latis, irregulariter sectis; dente cardinali magno, sulcato.*" (*Deshayes.*)

Shell roundedly ovate, gibbous or irregularly tumid, thick and strong, covered with foliaceous and reflected lines of growth, with protuberant short spines; interspaces between lamellæ irregularly distant; cardinal tooth large and sulcated.

Diameter, $2\frac{1}{2}$ inches.

Localities. Bracklesham, Bramshaw Brook, Huntingbridge, Stubbington (*Edwards*). France: Calc. gross., Parnes, Chaumont, &c. (*Deshayes*).

This species does not appear to be abundant, especially of the size of the specimen figured, although it is stated by M. Deshayes to have been found much larger in France. The name *gigas* is retained for this species, though by no means an appropriate one. *Chama gigas*, Linné, is a very different shell, and was appropriately applied to the largest species in the class *Bivalvia*, now known under the generic name of *Tridacna*.

Our present species seems to have adhered by its entire side when young, and occasionally so till nearly full grown. This attachment is by the anterior or pedal region. Fig. 3 is, perhaps, the young state of this species, resembling the shell called *papyracea*, and fig. 4 represents a specimen which, from its strong adherence, had produced a prominent ridge of reflected fimbriæ, like *plicatella*. These, I think, are only varieties of *gigas*. Although this genus stands pretty well isolated, there is a more than common difficulty in pointing out what are presumed to be their specific differences.

4. Chama squamosa, *Solander*. Pl. XXV, fig. 6 *a—d*.

Chama squamosa, *Solander* (in *Brander*). Foss. Hanton., pl. vii, figs. 86, 87, 1776.
— — *J. Sowerby*. Min. Conch., t. 348, 1822.
— — *G. B. Sowerby*. Genera of Shells (*Chama*), fig. 4, 1839.

Spec. Char. Testâ crassâ, suborbiculatâ, irregulari, multilamellatâ, fimbriatâ, longitudinaliter multistriatâ aut radiatâ; lamellis numerosis, incrassatis, subplicatis; striis flexuosis; umbone valvæ inferiore majore, contorto, aliquando producto; cardine crasso, rugoso.

Shell thick, suborbicular, irregular, covered with numerous fimbriated lamellæ, and numerous longitudinal or rather radiating and bending or undulating striæ; lower or left valve the larger, with the umbo sometimes much produced; hinge with a large rugose tooth; inner margin of valve smooth.

Longest diameter, $1\frac{5}{8}$ths inch.

Locality. Barton.

This is very abundant at Barton, but I do not know it from any other locality, although it is given in Morris's 'Catal. of Brit. Foss.,' 2nd Edit., p. 194, as from Bracklesham Bay. In the 'Ann. du Mus.,' vol. viii, p. 348, Lamarck refers his Paris Basin shell *C. lamellosa* to the British species figured by Solander. Deshayes omits Solander's name from his synonyms, giving his reasons for believing the French shell to be quite distinct; and I am of his opinion. Our shell is very variable, but it is always closely radiated and fimbriated. Sometimes specimens are much distorted, resembling in that respect *Diceras*; adhering only by the umbo, the shell twisting in a spiral manner, carrying up a depressed ridge of the deserted and disused connector (fig. 6 *d*). Some specimens are tinted with a reddish brown, which I imagine to be part of the original colour.

5. Chama sulcata (?), *Deshayes*. Pl. XXV, fig. 7.

Chama sulcata, *Desh*. Coq. Foss. des Env. de Par., vol. i, p. 250, pl. xxxviii, figs. 8, 9, 1825.
— — *Id*. An. sans Vert. du Bass. de Par., vol. i, p. 585, 1860.

Spec. Char. C. "*T. ovato-orbiculatâ, convexâ, turgidâ, profundâ, lamellosâ, longitudinaliter multisulcatâ; lamellis irregularibus, brevissimis; sulcis undulatis, numerosis, convexis; dente cardinali oblongo, brevi, sulcato.*"—*Desh.*

Shell irregular, ovate or orbicular, convex, thick, tumid, deep, and lamellated; longitudinally sulcated or radiated; concentrical or periodical lamellæ irregular and short; cardinal tooth short and sulcated.

Localities. Bracklesham Bay and Barton (*Edwards*).
France: Chaumont, Calc. gross. inf. (*Deshayes*).

The lamellæ are dwarfish and the rays broad, flat, and regular. The specimen figured is a lower valve, and had been attached by nearly half the entire surface. The rays are much more numerous than upon *Ch. squamosa*. The inner lining of this shell is without punctures. The tooth of the lower or adherent valve is rugose; so also is the place of its reception in the opposite valve.

6. Chama Selseyensis, *Edwards* MS. Pl. XXV, fig. 5.

Spec. Char. Testâ orbiculato-rotundatâ, inflatâ, valvâ sinistrâ majore; umbonibus obliquis, incurvatis; lamellis transversis distantibus, acutis, interstitiis lævigatis; cardine unidentato in valvulâ sinistrâ.

Shell more or less rounded and inflated; left valve the lower and larger; beaks oblique and incurved, covered with smooth and sharp lamellæ; interstices free from radiations; one tooth in the left valve.

Diameter, 1 inch.

Locality. Selsey (*Edwards*).

Several specimens of what is here considered as a distinct species are in Mr. Edwards's cabinet, all exhibiting the same peculiarly smooth character like the one figured, from which it seems to have been entitled to specific isolation. I believe it is so, and have adopted the MS. name. It appears to be distinguished from *gigas* by the smoothness of the exterior and the freedom from fimbriated lamellæ. It somewhat resembles *Ch. inornata*, Desh. (pl. lviii, figs. 20—22), and might possibly be the same if a large series of each could be examined and compared; but the French shell seems to be elaborately ornamented with undulating fimbriæ, and I have preferred keeping it as a distinct species for the present.

7. Chama turgidula (?), *Lamarck*. Pl. XXV, fig. 9 *a—c*.

Chama turgidula, *Lam.* An. sans Vert., 2nd ed., t. vi, p. 585, fide *Desh.*, 1860.
— rusticula, *Desh.* Coq. Foss. des Env. de Par., p. 249, pl. xxxvii, figs. 7, 8, 1825.
— substriata, *Id.* Ibid., pl. xxxviii, figs. 1—3, 1825.

Spec. Char. Ch. Testâ suborbiculatâ, convexâ, crassâ, multilamellatâ, longitudinaliter multistriatâ; lamellis numerosis incrassatis, subplicatis; striis flexuosis, approximatis; umbone valvæ inferioris contorto.

Shell suborbicular, convex, thick, numerously striated with somewhat close-set fimbriæ; umbo of inferior valve incurved.

Diameter, 1 inch.

Locality. Barton.

This appears to differ from *squamosa* in having rather more fimbriated lamellæ, but it is doubtfully distinct. M. Deshayes has united two shells previously considered by himself as specifically separated. From this I presume the French specimens present great variations. Our specimen appears to be intermediate between the two varieties *rusticula* and *substriata*.

8. Chama prisca, *S. Wood.* Pl. XXV, fig. 10.

Locality. London Clay. Railway-cutting, Finchley.

The figure referred to represents a small shell received from Mr. Edwards with the above locality attached. This is the first specimen that either Mr. Edwards or myself have seen from any Eocene deposit in England below the beds of either Barton or Bracklesham. It is the upper valve, and has been somewhat rubbed. Its imperfect condition unfits it for satisfactory specific determination, but I imagine it to be distinct, from its strongly marked radiations and its imperfect or obsolete concentric fimbriæ.

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CORRIGENDA.

For *Ostrea prona*, p. 29, read *Ostrea ventilabrum*, Goldf.

Ostrea pulchra, p. 30; this name should be restricted to the small shell from Bromley; the large shell from Reading, figured in Plate I, is probably a distinct species, which might be called *Ostrea pulcherrima*.

For *Modiola Deshayesiana*, p. 76, read *Modiola Deshayesii*.

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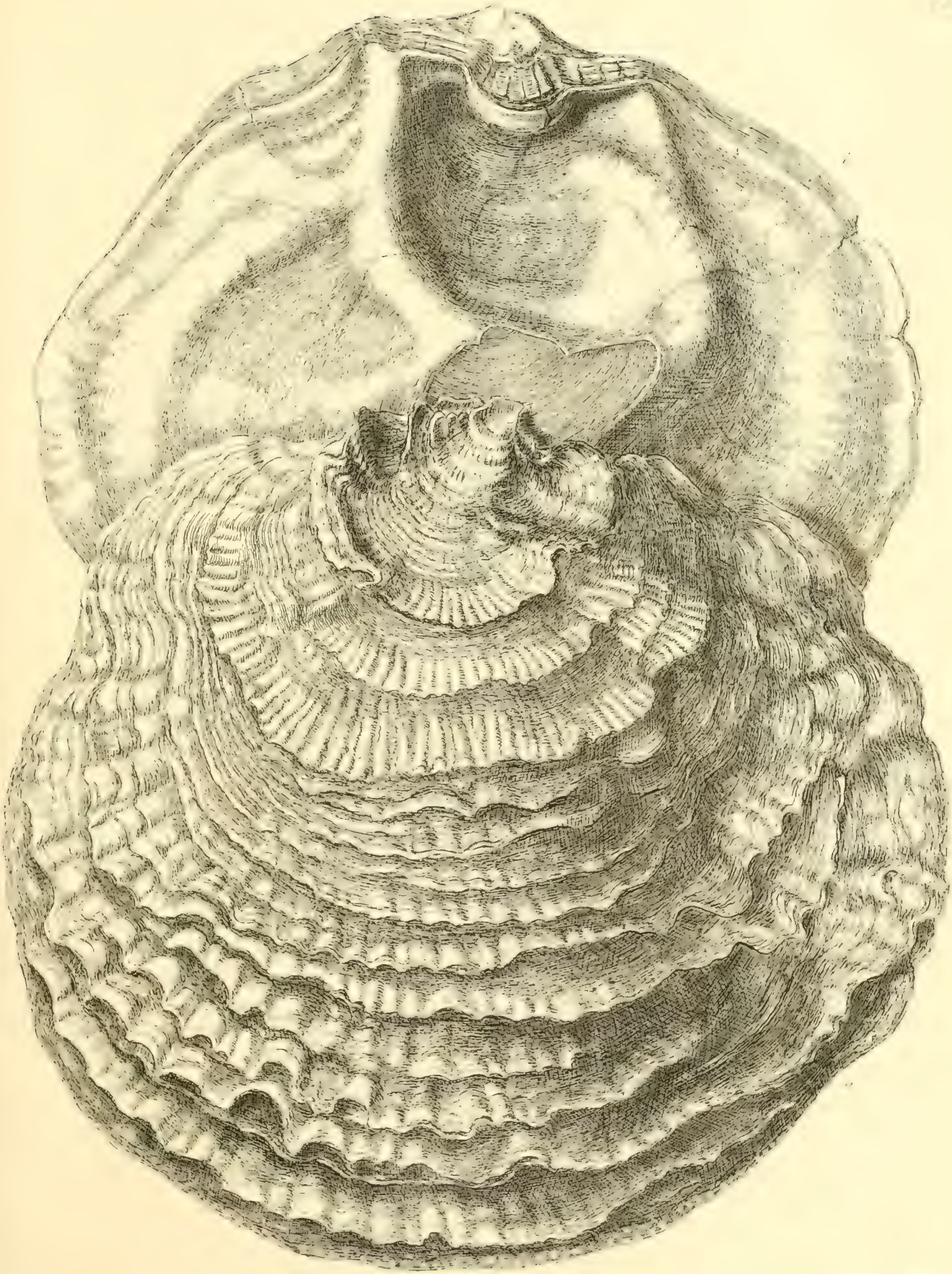
TAB. I.

Ostrea pulchra, *page* 30.

Specimen from near Reading, with connexus preserved. Mus. Edwards.

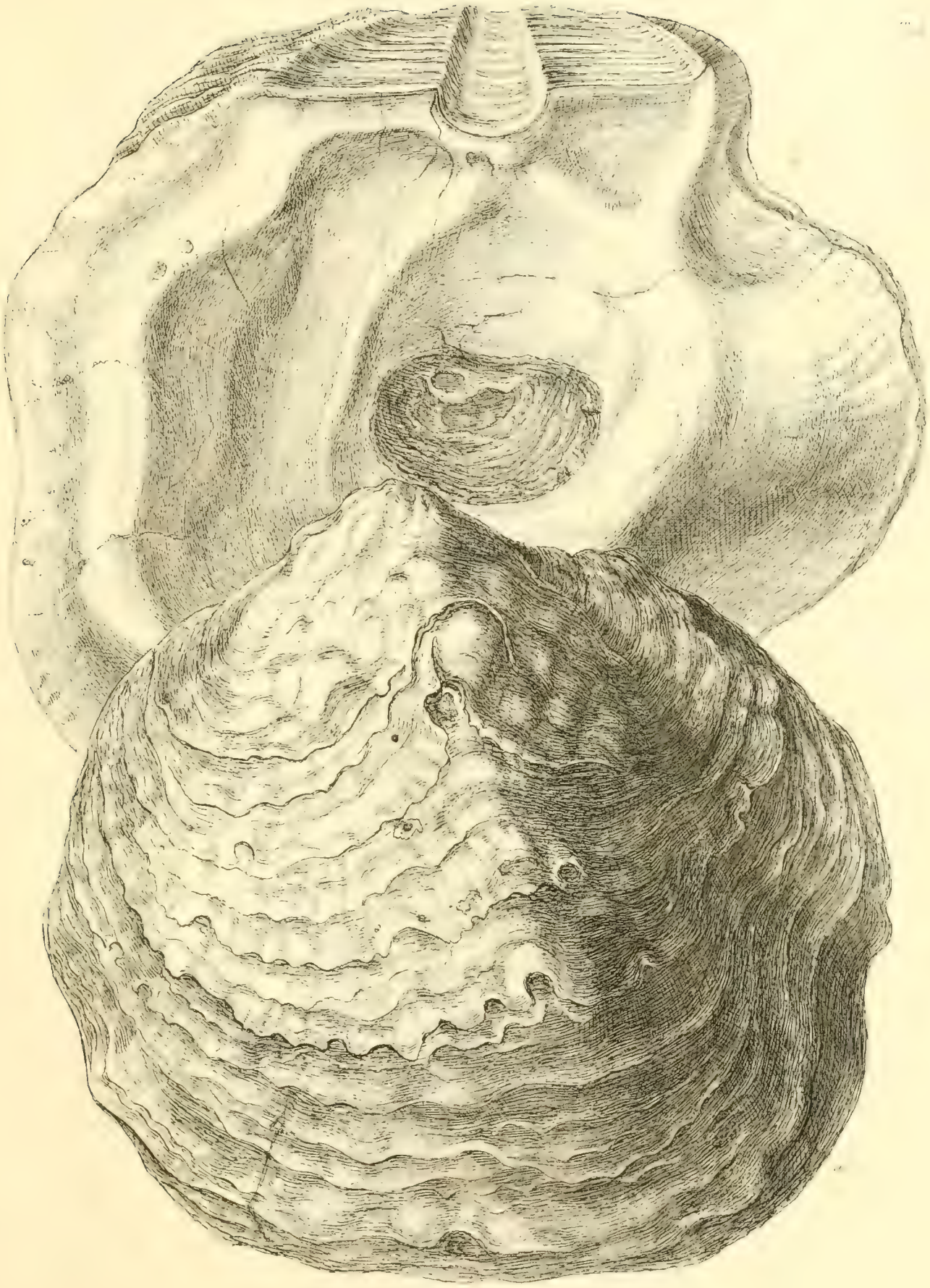


TAB. II.

Ostrea gigantea, *page* 23.

a. outside view of lower valve, showing a very small mark of attachment. Mus. Bowerbank.

b. inside view of upper or right valve. Mus. Edwards (? elephantopus).



TAB. III.

Fig.

1. Ostrea Bellovacina, *page* 17.

   a. outside view of upper valve from Charlton. Mus. Edwards.

   b. outside view of lower valve „

2. Ostrea cymbulöides, *p.* 20.

   From Herne Bay. Mus. Bowerbank.

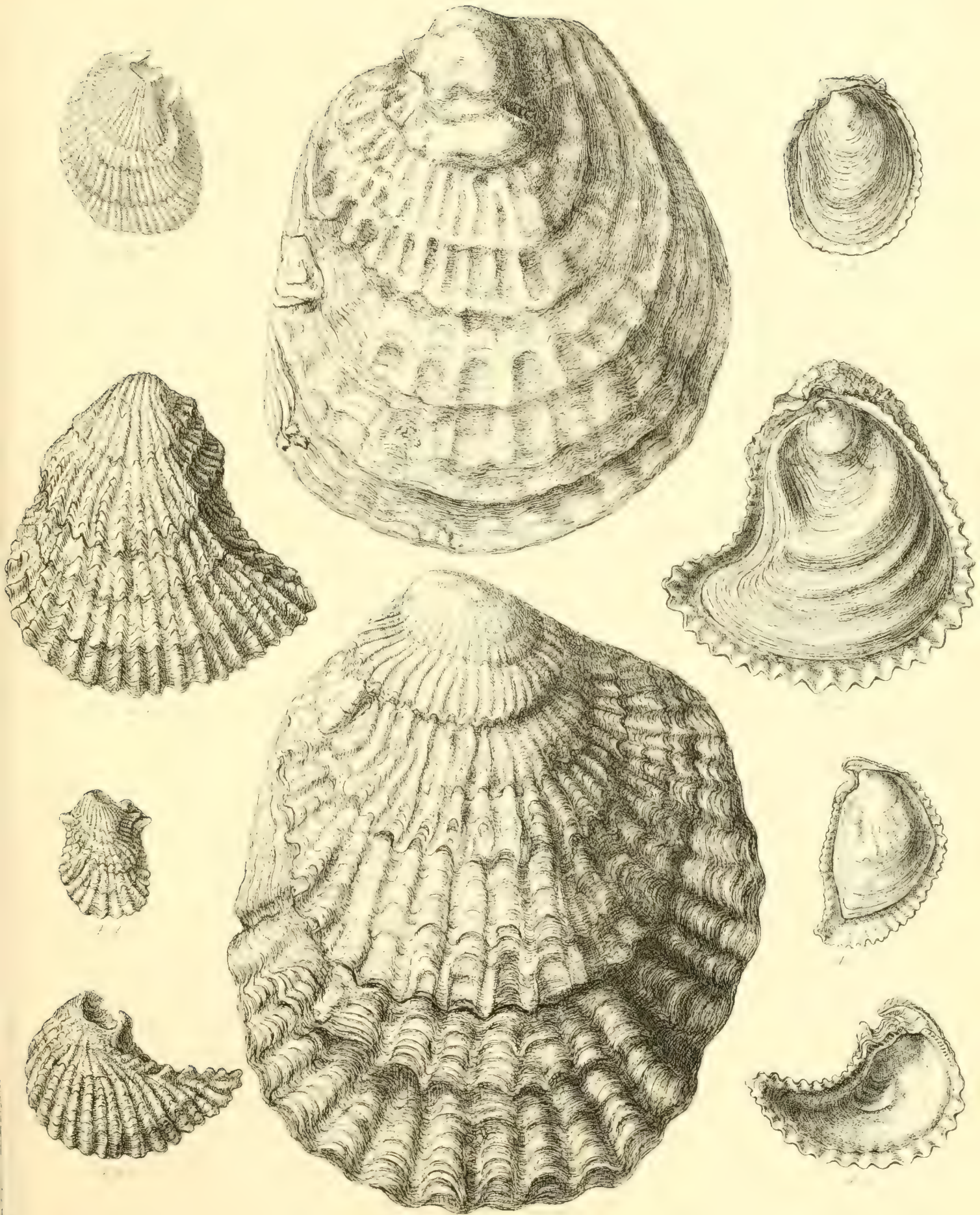
3. Ostrea prona, *p.* 29.

   From Brockenhurst. Mus. Edwards.

4. Ostrea flabellula, *p.* 21.

   a. outside, normal form, from Bramshaw. Mus. Edwards.

   d. outside, abnormal form, from Barton. „



TAB. IV.

Fig.

1. Ostrea tabulata, *page* 31.

   a. outside view, upper valve, from Bognor. Mus. Edwards.
   b. outside view, lower valve, ,, Mus. Jermyn Street.

2 *a.* outside view of the upper valve of an oyster from Clarendon, with greatly incurved umbo like Exogyra; supposed to be the young state of O. pulchra. Mus. Edwards.

2 *b.* inside of another specimen, with margin denticulated near the hinge, same locality, supposed also to be the young state of O. pulchra. Mus. Edwards.

3. Ostrea flabellula juv.? *page* 21.
   From Barton. Mus. Edwards.

TAB. V.

FIG.

1. Ostrea callifera, *page* 18.

   a. inside view of lower valve. Mus. Jermyn Street.

   b. united valves, umbo inflected in a contrary direction. Mus. Edwards.

2. Ostrea adlata, *p.* 16.

   a, b. out and inside views of lower valve. Mus. Edwards.

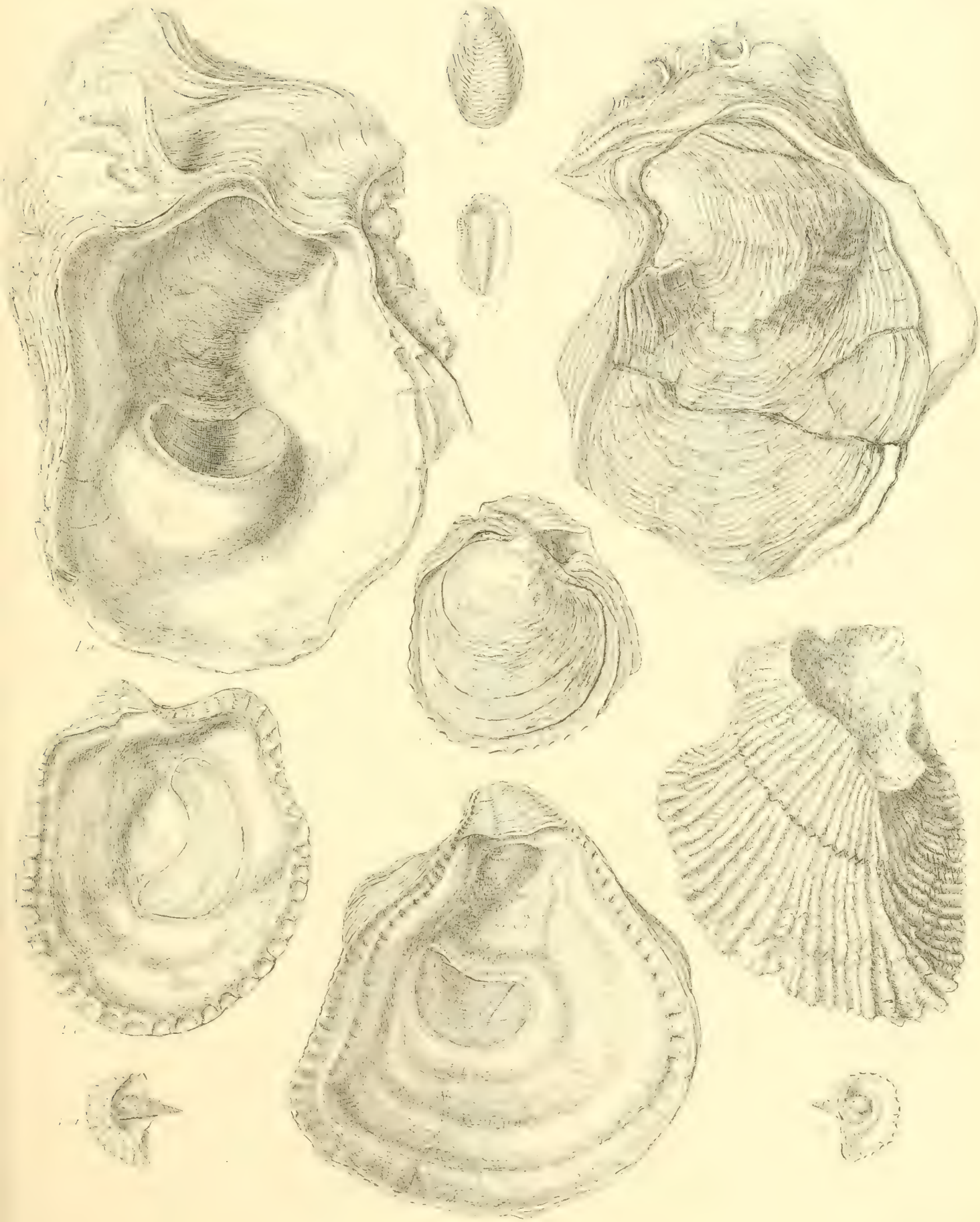
   c. inside view of upper valve. Mus. Edwards.

   d. inside view of lower valve, abnormal state. Mus. Edwards.

3. Ostrea marginidentata, *p.* 27.

   a. inside view of upper valve, showing the altered form of muscle-mark. Mus. Edwards.

   d. inside view of lower valve, with normal form of muscle-mark. This specimen had been attached by the entire outer surface. Mus. Edwards.



TAB. VI.

Fig.

1. Ostrea tenera, *page* 31.

   Specimen from Bracklesham. Mus. Edwards.

2. Ostrea dorsata, *p.* 20.

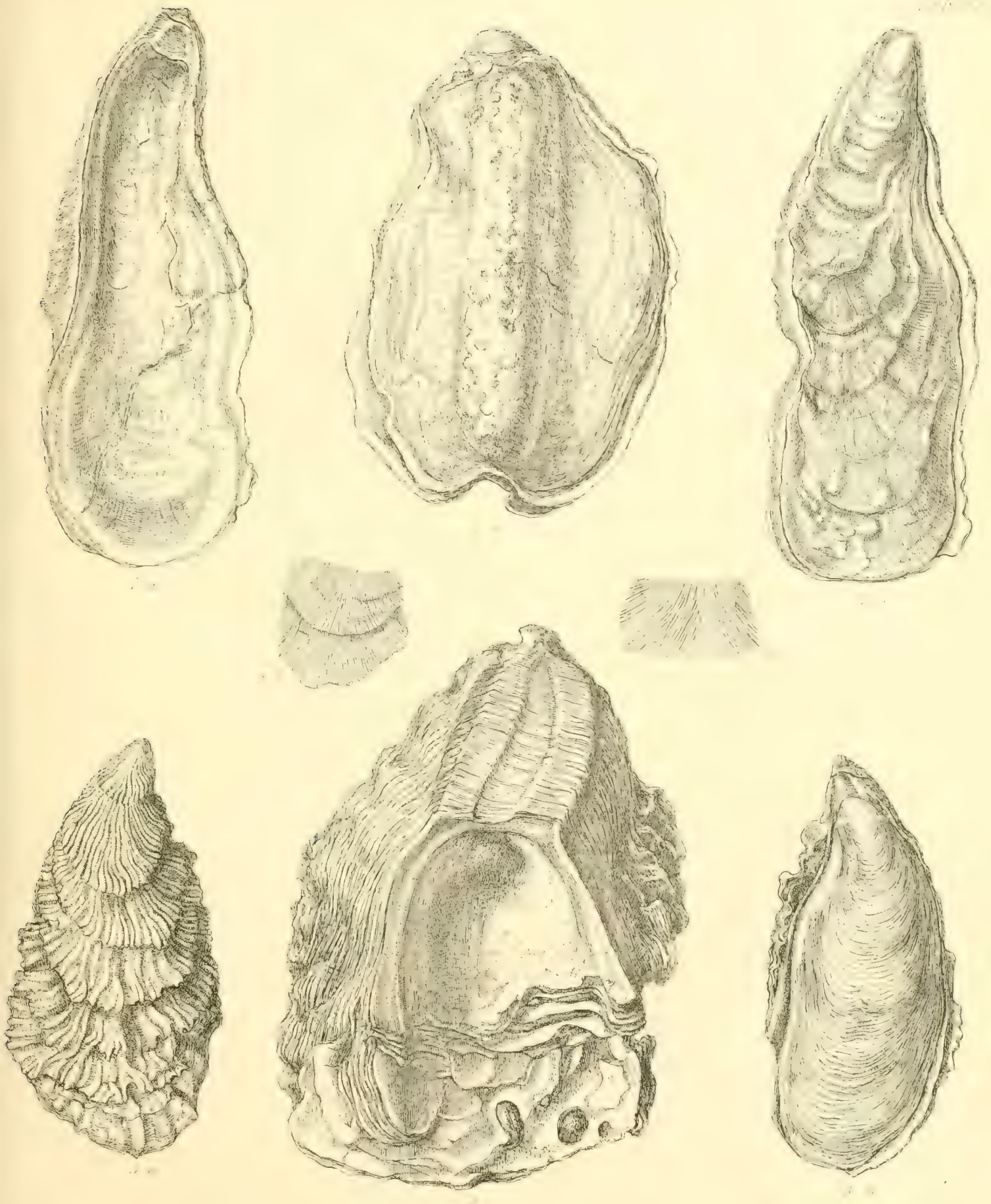
   Specimen with united valves, showing it to have been attached to some cylindrical body, which circumstance had communicated a semi-cylindrical elevation to the centre of both valves. Mus. Edwards.

3. Ostrea multicostata? *p.* 28.

   From Bracklesham. Mus. Edwards.

4. Ostrea longirostris, *p.* 26.

   Specimen of lower valve, with a broad mark of adherence. This specimen has been perforated by several stone-eating bivalves. Mus. Edwards.



TAB. VII.

Fig.

1. Ostrea velata, *page* 33.
   b. outside view of upper valve, showing the broad striæ. Mus. Edwards.

2. Ostrea picta, *p.* 28.
   Mus. Brit.

3. Ostrea Bellovacina, *p.* 17.
   a. outside view of lower valve, from Peckham. Mus. Edwards.
   b. inside of upper valve, from Peckham. The exterior of this specimen is free from radiating costæ. Mus. Edwards.
   c. portion of the outside of upper valve of another specimen from Peckham. Mus. Edwards.

4. Ostrea inflata? *p.* 26.
   Mus. Edwards.

5. Ostrea Vectiensis, *p.* 32.
   a. inside view of right valve. Mus. Jermyn Street.
   b. ,, left valve. ,,
   (? Ostrea gryphina. Forbes.)
   c. inside of upper valve of a very thick (old?) specimen, much elevated. Mus. Jermyn Street.
   (? Ostrea Sparnacensis.)

6. Ostrea gryphovicina, *p.* 25.
   a. outside view of lower valve. Mus. Wetherell.
   b. inside of the lower or left valve, showing the linear hinge-area. Mus. Bowerbank.

7. Ostrea cyathula? *p.* 19.

1. a

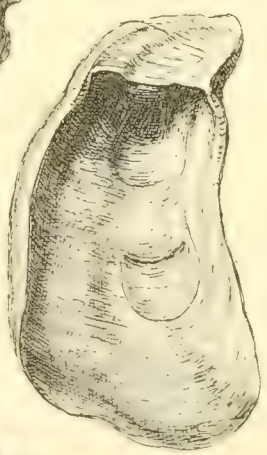
1

1. b

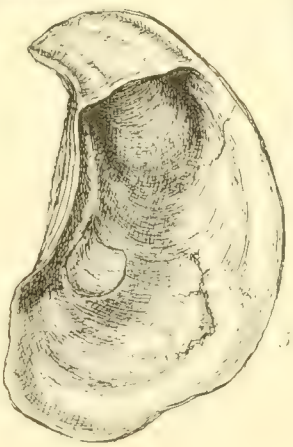
3. a

4

2



3. a



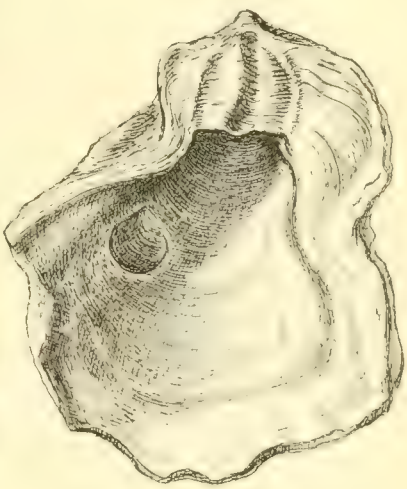
3. b

3. c

5. c

6

7

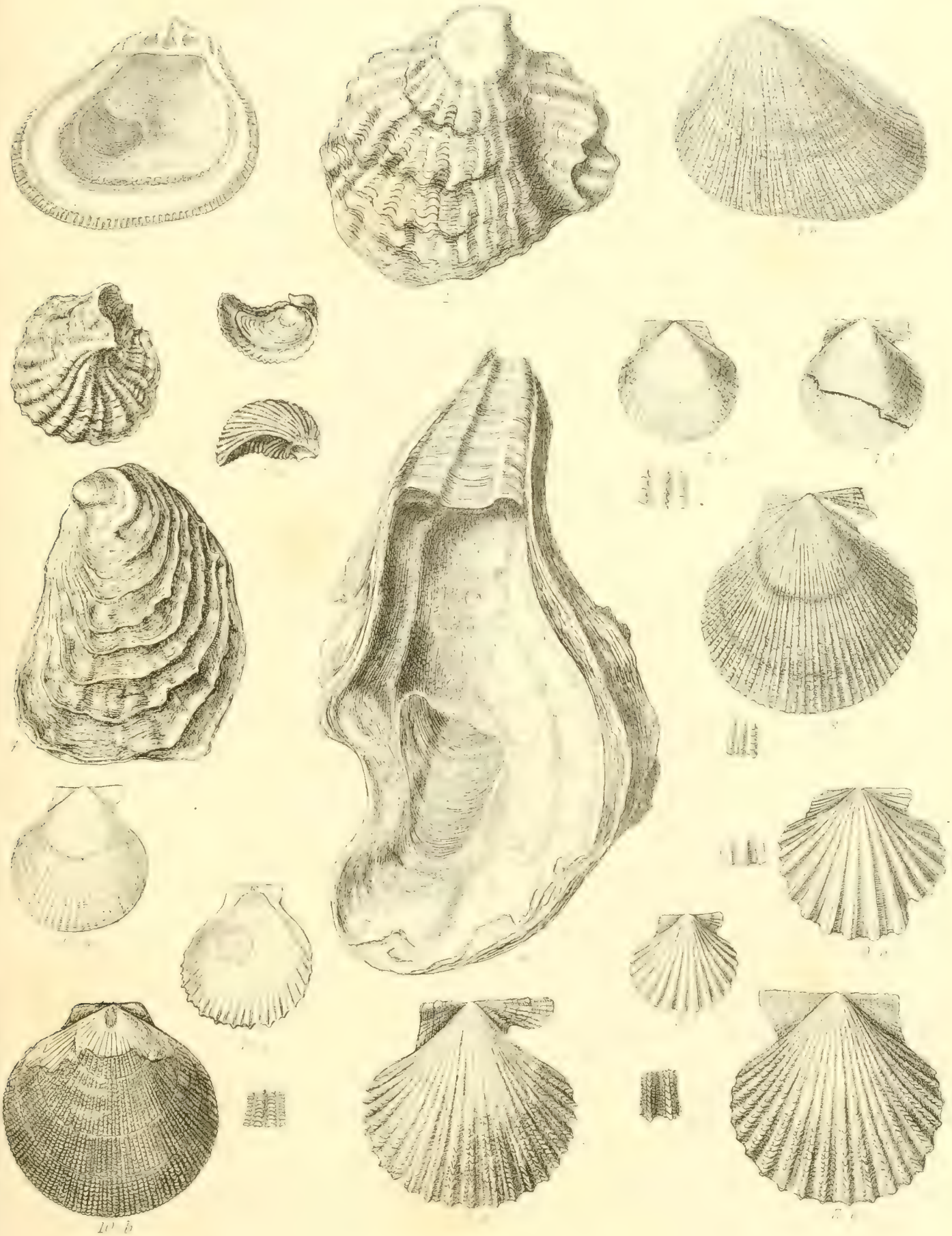


8. b

TAB. VIII.

Fig.

1. Spondylus rarispina, *page* 51.
   a. view of the inside of the left or free valve.
   b. ,, outside of the same. Mus. Edwards.
2. Ostrea aliena, *p.* 16. Mus. Edwards.
3. ,, cyathula, *p.* 19. ,,
4. ,, zonulata? *p.* 34. ,,
5. ,, flabellula (*var. modicella*), *p.* 21. Mus. Edwards.
6. ,, gigantea, *p.* 23. Mus. Edwards.
7. Pecten Prestwichii, *p.* 42.
   a. left valve. Mus. Bowerbank.
   b. right valve. Mus. Prestwich.
   The portion beyond the fracture in the right valve is made up.
8. Pecten 30-radiatus? var. 40-radiatus, *p.* 45. Mus. Brit.
9. Pecten idoneus, *p.* 41. Mus. Edwards.
10. Pecten duplicatus, *p.* 41.
    a. view of the outside of the right valve. Mus. Edwards.
    b. ,, ,, left valve, with imperfect? auricles. Mus. Edwards.
    c. view of the inside of the left valve of a more elevated specimen. Mus. Wetherell.
11. Pecten bellicostatus, *p.* 38. Mus. Edwards.



TAB. IX.

FIG.

1. Anomia tenuistriata, *page* 13.

   a. view of outside of the upper valve, normal form. Mus. Edwards.
   b. ,, inside of the lower valve. Mus. Edwards.
   c. ,, outside of the upper valve, with radiations. Mus. Edwards.
   d. ,, inside of the upper valve, showing muscular impressions. Mus. Edwards.
   e. specimen showing the disproportion of united valves. Mus. Edwards.

2. Vulsella deperdita, *p.* 35.

   a. view of a united pair of valves of medium form. Mus. Edwards.
   b. right valve of a depressed specimen. Mus. Edwards.
   c. view of outside of the left valve of an elevated specimen. Mus. Jermyn Street.

3. Pecten reconditus, *p.* 42.

   ? *a.* orbicular specimen from Barton, with thirty rays.
   b. left valve of an elevated specimen, with eighteen rays.
   c. right valve of an elevated specimen, with twenty rays.

4. Pecten 30-radiatus, *p.* 45.

   Right and left valves, with sections of varieties.

5. Pecten carinatus, *p.* 38. Mus. Edwards.

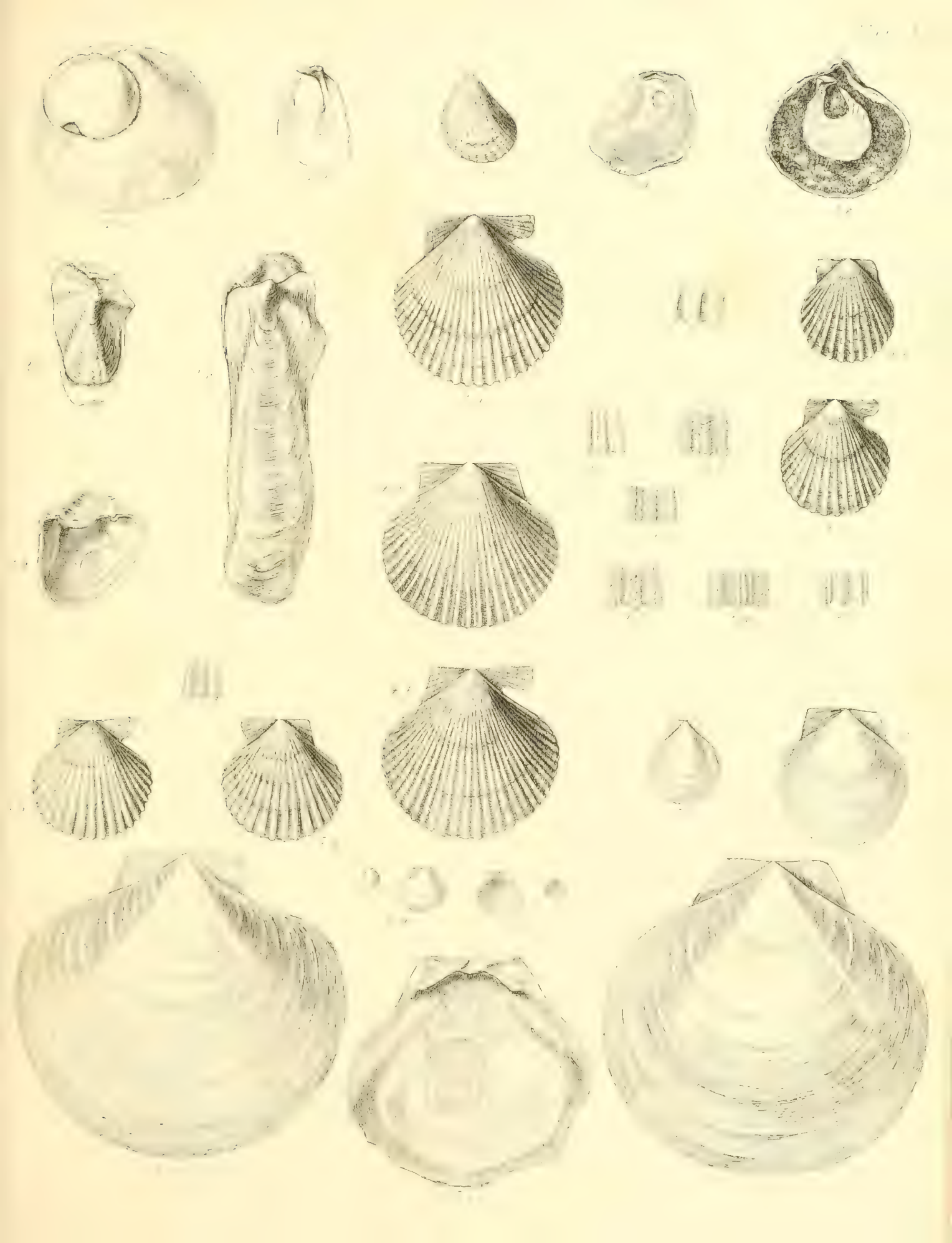
6. ,, squamula, *p.* 44. ,,

   The two larger figures are magnified representations.

7. Pecten corneus, *p.* 39. Mus. Edwards.

   a, *c.* views of the outsides of the right and left valves.
   b. view of the inside of the left valve.
   d. ,, ,, of specimen from Highgate (var. *corneolus*). Mus. Edwards.

8. Pecten contubernalis, *p.* 40. Mus. Edwards.



TAB. X.

Fig.

1. Pinna affinis, *page* 55.

   a. view of the left valve. Specimen from Bognor. Mus. Edwards.
   c. var. *intermedia*. Mus. Prestwich.

2. Pinna pyriformis, *p*. 57. Mus. Prestwich.

3. Pecten duplicatus, *p*. **41.**

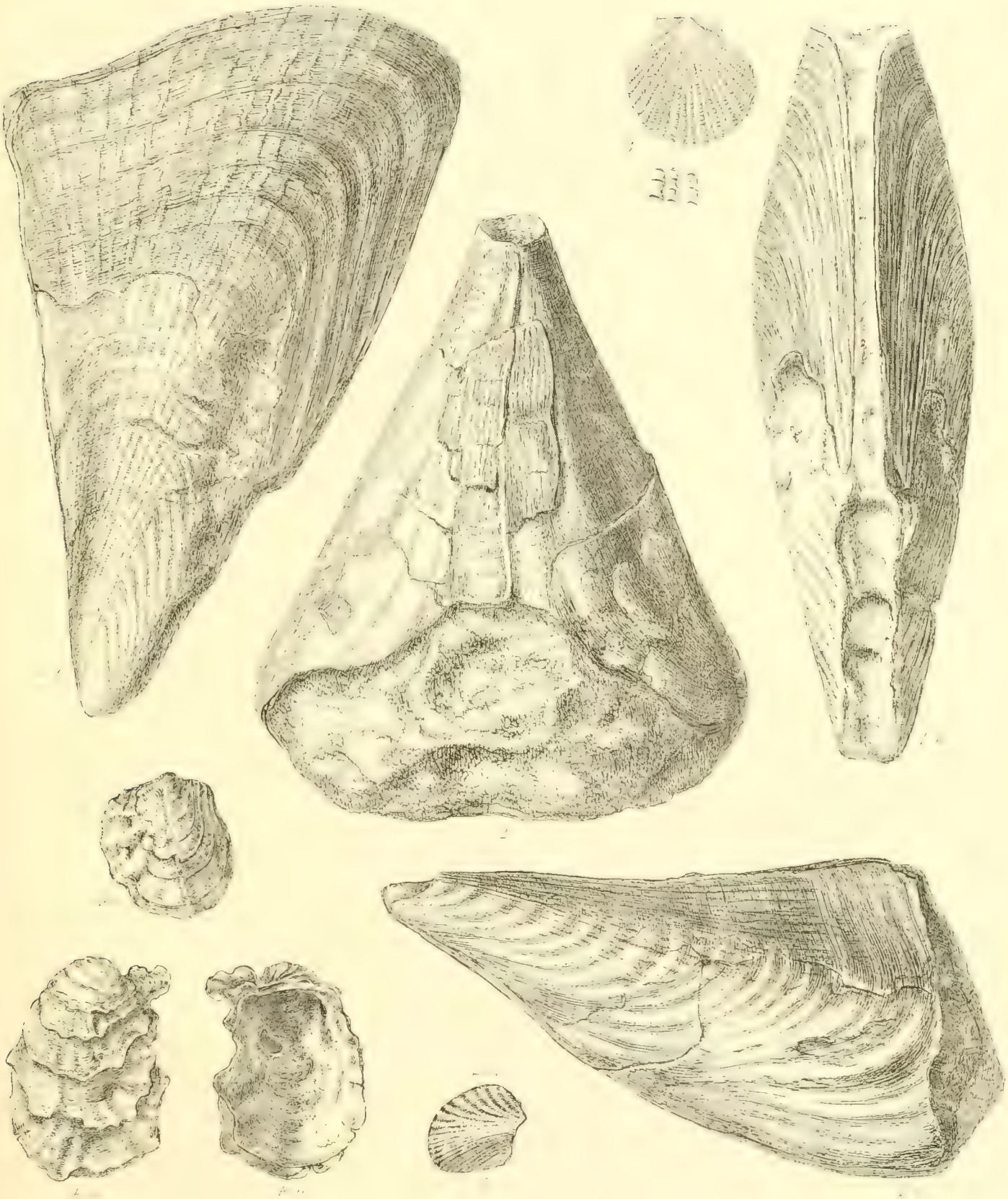
A strongly imbricated specimen of the left valve, with perfect auricles, from Highgate. Mus. Wetherell.

4. Ostrea zonulata, *p*. 34. Mus. Fisher.

5. Modiola diversa, *p*. **74.**

Fragment of a specimen, enlarged. Mus. Edwards.

The line denotes the size of the specimen.



TAB. XI.

Fig.

1. Avicula media, *page* 53.
   a, *d*. right and left valves of an elevated specimen from Brockenhurst. Mus. Edwards.
   b, *c*. specimen from Barton. Mus. Edwards.

2. Avicula papyracea, *p*. 54.
   a. view of the interior of a young? specimen from Haverstock Hill. Mus. Edwards.
   b, *c*. adult specimens from Highgate. Mus. Edwards.

3. Avicula arcuata, *p*. 53. Mus. Wetherell.

4. Lima compta, *p*. 48. Mus. Edwards.

5. Anomia scabrosa, *p*. 14. ,,

6. Lima expansa, *p*. 49. ,,

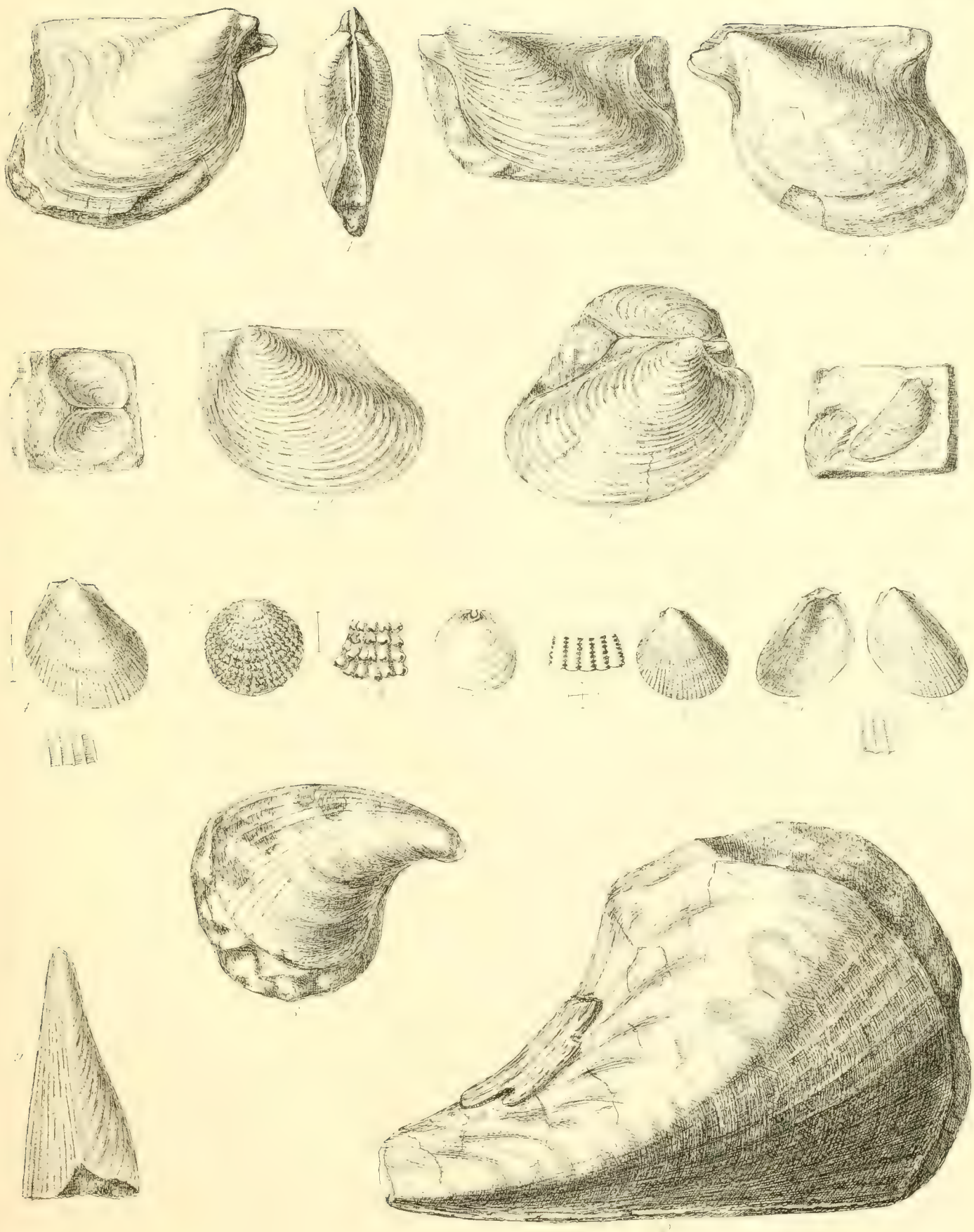
7. ,, soror, *p*. 49. ,,

8. Pinna arcuata, *p*. 56. Mus. J. Sowerby.

9. ,, margaritacea, *p*. 56. Mus. Brit.

10. ,, pyriformis, *p*. 57. Mus. Prestwich.

The lines denote the size of the specimens.



TAB. XII.

Fig.

1. Mytilus affinis, *page* 61.

   a, *c*, *d*. specimens from Colwell Bay. Mus. Edwards.
   b. specimen from Barton. Mus. Edwards.

2. Mytilus strigillatus, *p*. 61. ,,

3. Dreissena Brardii, *p*. 59.

   a. view of the interior of the left valve, in which is a specimen of the arenaceous case of a Sabella?

4. Modiola depressa, *p*. 63. Specimen from Highgate. Mus. Wetherell.

5. Modiola elegans, *p*. 65.

   a. var. inelegans, from Highgate. Mus. Wetherell.
   b. elegans, from Highgate. Mus. Wetherell.
   c. var. elegantior, from Hordwell. Mus. Edwards.

6. Modiola hastata, *p*. 67.

   Specimens from Brook. Mus. Edwards.

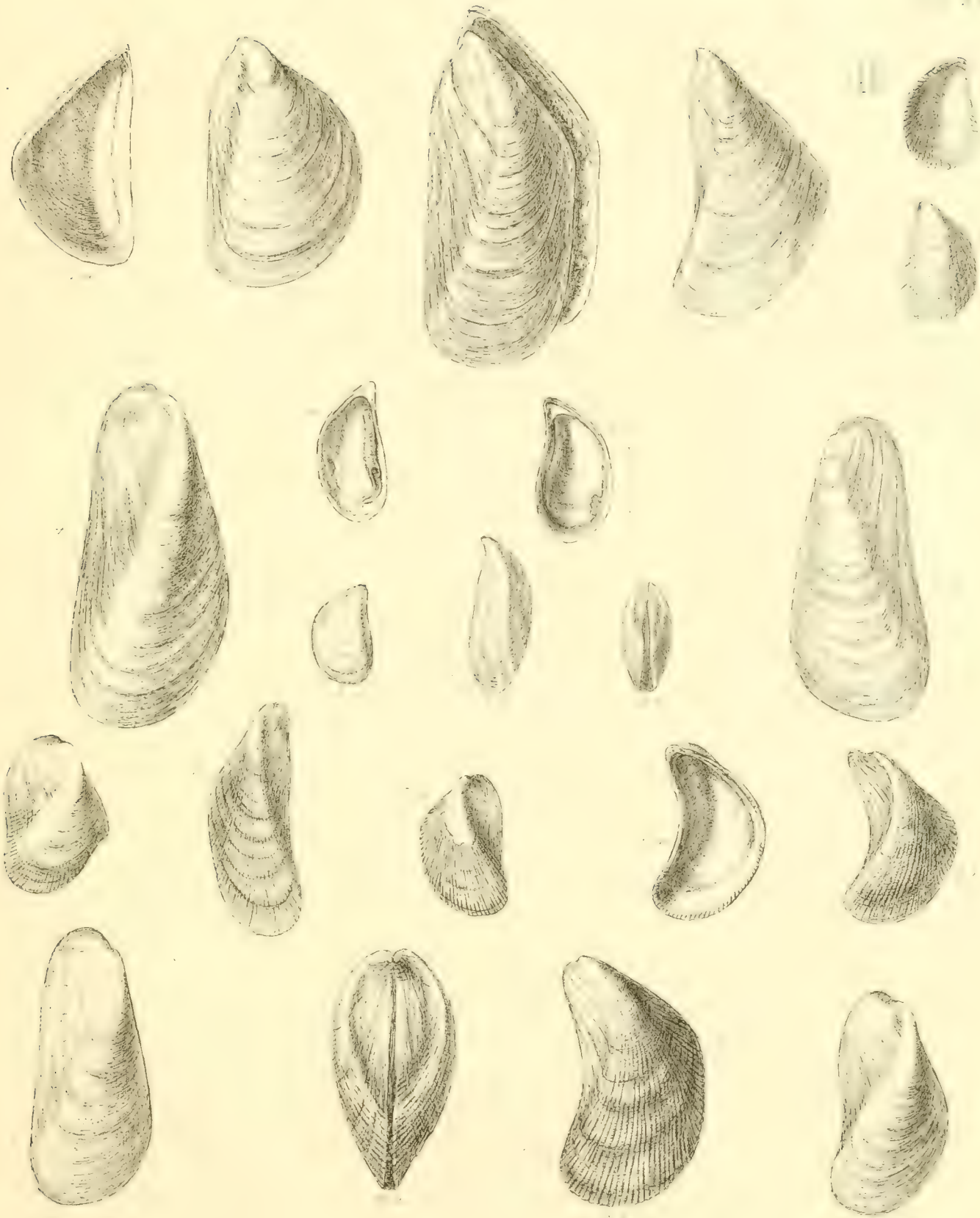
7. Modiola simplex, *p*. 71.

   a. specimen from Herne Bay. Mus. Edwards.
   b. ,, Bognor. ,,

8. Modiola Nystii, *p*. 68. Mus. Edwards.

9. Modiola subcarinata, *p*. 71.

   Specimen from Highgate. Mus. Wetherell.



TAB. XIII.

Fig.

1. Modiola semi-nuda, *page* 70. Mus. Edwards.
2. ,, dorsata, *p.* 65. Mus. Prestwich.
3. ,, tenuistriata, *p.* 73. Mus. Edwards.
4. ,, pygmæa, *p.* 70. ,,
5. ,, dimidiata, *p.* 64. ,,
6. ,, eximia, *p.* 66. ,,
7. ,, Prestwichii, *p.* 69. ,,
8. ,, nodulifera, *p.* 68. ,,
9. ,, flabellula, *p.* 67. ,,
10. ,, Mitchelli, *p.* 68. Mus. Morris.
11. ,, sulcata, *p.* 72. Mus. Edwards.
12. ,, ? tubicola, *p.* 73. Mus. Jermyn Street.
13. ,, undulata, *p.* 74. Mus. Geol. Soc.
    b. an imaginary specimen.
14. ,, Deshayesii, *p.* 64.
15. ,, dimidiata? (cast of), *p.* 64. Mus. Brit.

The lines denote the size of the specimens.

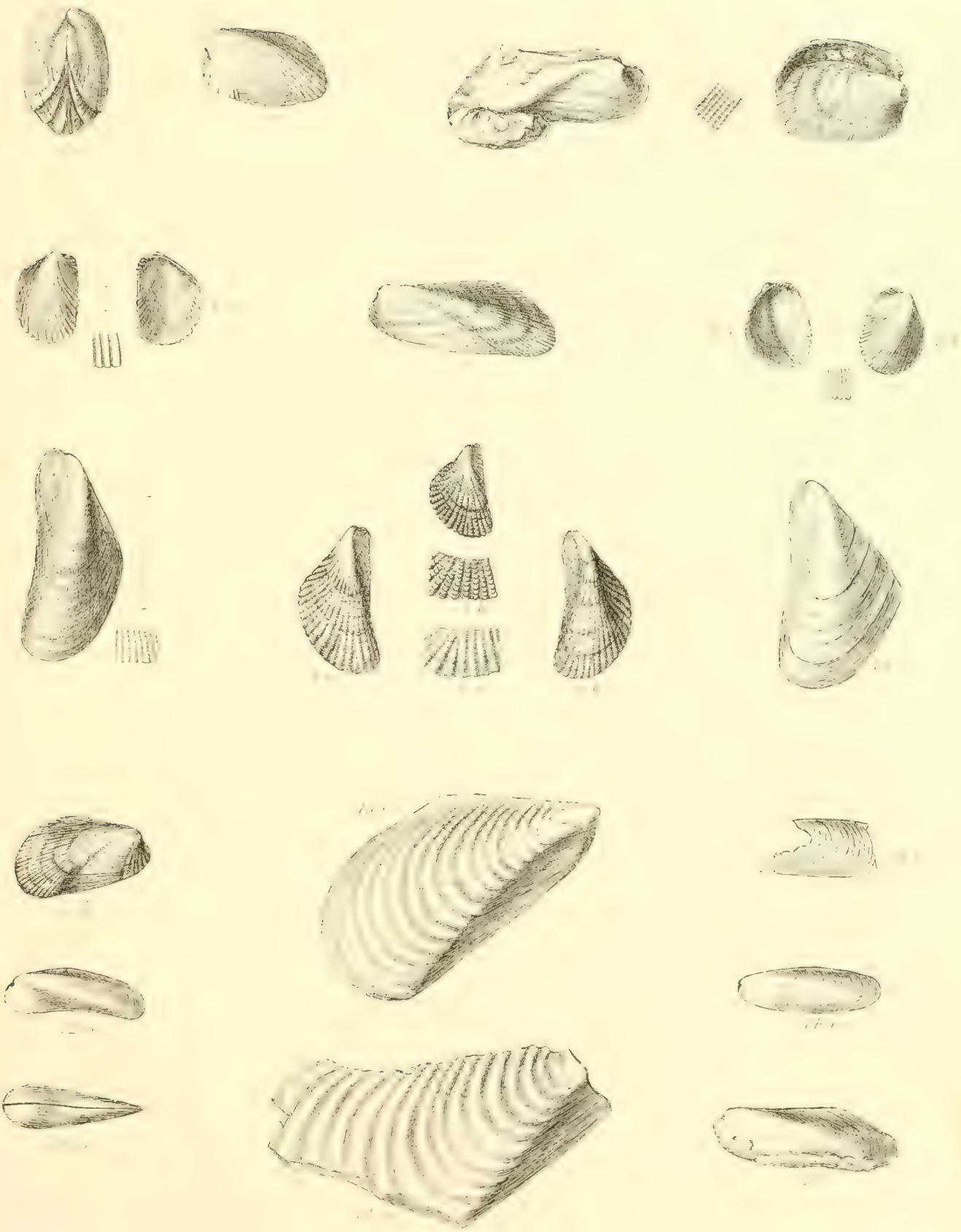


TABLE XIV.

FIG.

1, *a—f.* Arca biangula, *page* 80.

c. specimen from Barton, var. *Branderi,* with ventral margins closed. Mus. Edwards.

f. specimen from Bracklesham, with large gape. Mus. Edwards.

2, *a, b.* Arca planicosta, *p.* 81. ,,

3, *a—f.* Arca appendiculata, *p.* 79. ,,

a, b. var. duplicata. ,,

d—f. specimen with area of connexus plain on the pedal side. Mus. Edwards.

4, *a, b.* Arca depressa, *p.* 82. Mus. Brit.

5, *a, b.* Arca modioliformis, *p.* 88. Mus. Edwards.

The lines denote the size of the specimens represented.

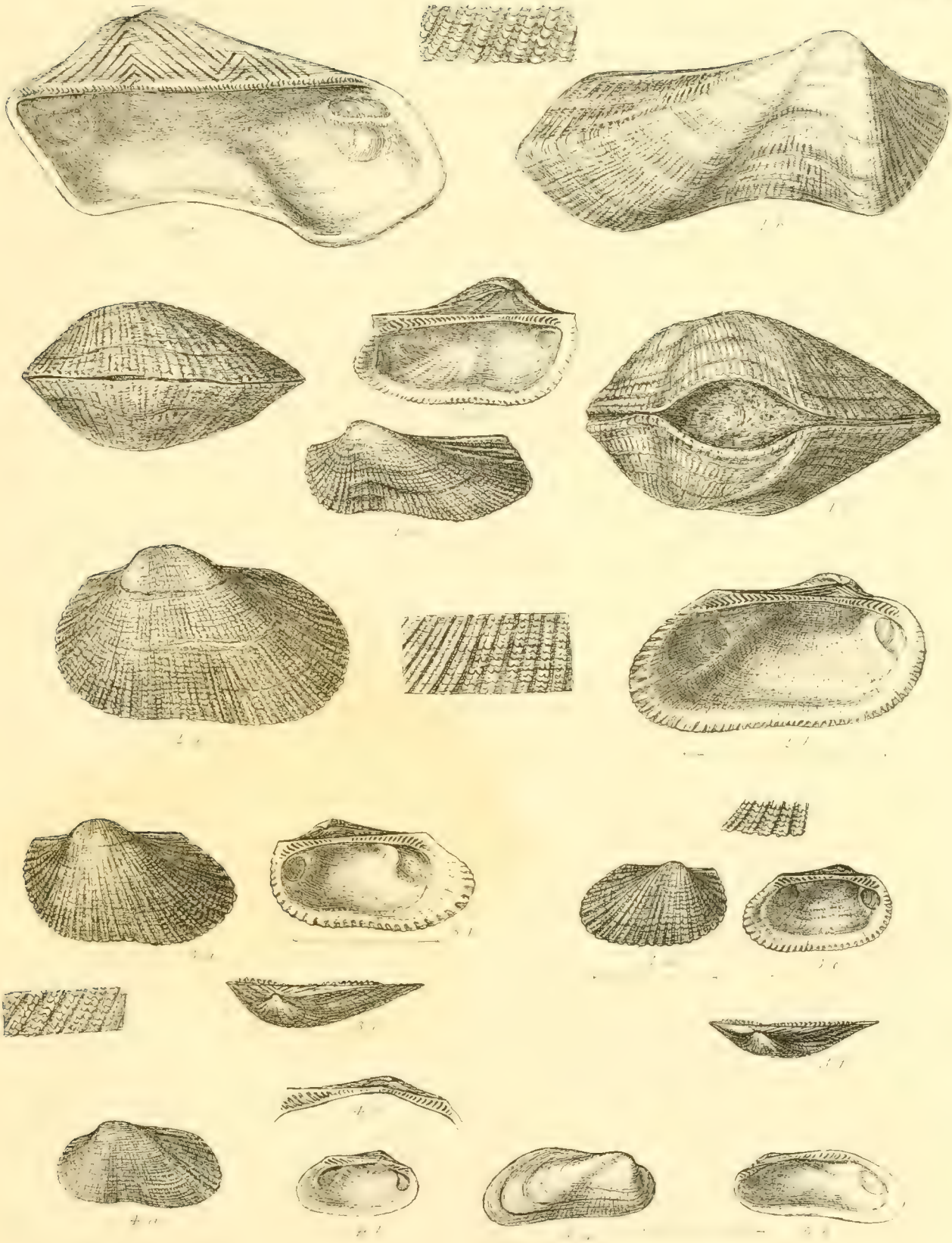


TABLE XV.

Fig.

1. *a*, *b*. Arca tumescens, *page* 92. Mus. Edwards.
2. *a*, *b*. „ interrupta, *p*. 85. „
3. „ eximia, *p*. 83. „
4. *a*, *b*, „ impolita, *p*. 84. „
   c. „ — ? var. Mus. Wetherell.
5. *a*, *b*. „ nitens, *p*. 88. Mus. Edwards.
6. *a*, *b*. „ Dulwichiensis, *p*. 82. „
7. *a*, *b*. „ Laekeniana, *p*. 80. „
   c. „ — ; var. *cylindrica*. Mus. Fisher.
8. *a*, *b*. „ lævigata, *p*. 86. Mus. Edwards.
   c. „ — ; hinge greatly enlarged.
9. *a*, *b*, „ globulosa ? *p*. 84 Mus. Edwards.
   c. „ — ; hinge greatly enlarged.
10. *a*, *b*. „ tegulata, *p*. 90. Mus. Edwards.
11. „ Websteri, *p*. 92. „
   a. „ — ; outside view of a specimen with less elevated siphonal region.
   b, *c*. „ — ; outside and inside views of another specimen.
12. *a*, *b*. „ Lyelli var. *contorta*, *p*. 87. Mus. Edwards.
13. *a*, *b*. „ — „ *lamellosa*. „
14. *a*, *b*. „ tessellata, *p*. 91. „
15. „ Dulwichiensis ? *p*. 82. Mus. Prestwich.

The lines indicate the size of the specimens.

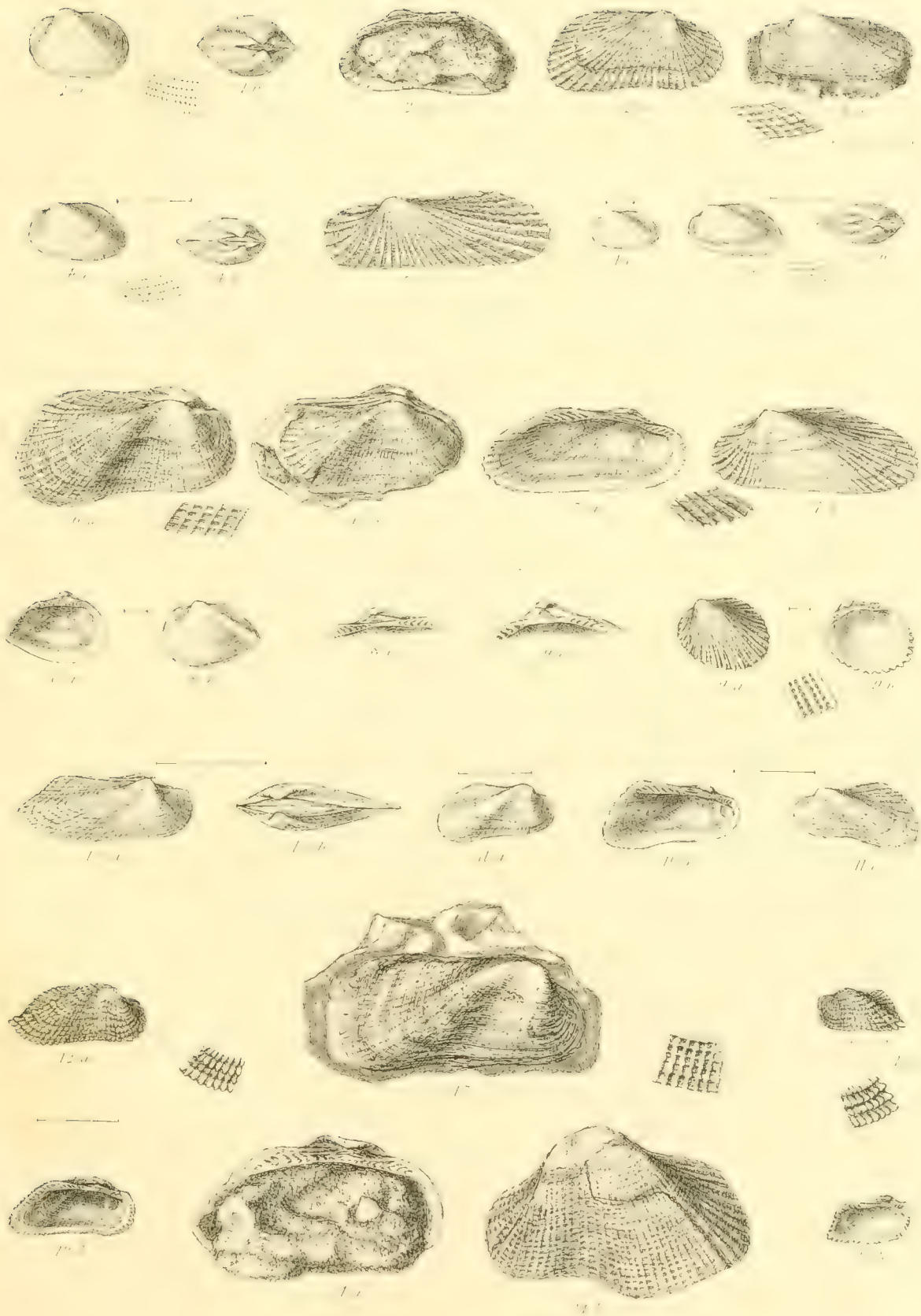


TABLE XVI.

Fig.			
1. *a*, *b*.	Pectunculus quasi-pulvinatus, *page* 100.	Mus. Edwards.
2. *a*, *b*.	,, pulvinatus, *p*. 99.	,,
3. *a*, *b*.	,, deletus, *p*. 97.	,,
4. *a*, *b*.	,, spissus, *p*. 101.	,,
5. *a*—*c*.	,, proximus, *p*. 99.	,,
6. *a*, *b*.	,, Plumsteadiensis, *p*. 98.	Mus. Brit.
7. *a*—*d*.	,, decussatus, *p*. 96.	Mus. Wetherell.
8.	,, brevirostris, *p*. 95.	Mus. Edwards.
9.	,, globosus, *p*. 98.	Mus. Brit.
10.	,, brevirostris? *p*. 95.	Mus. Edwards.

The lines indicate the size of the specimens.

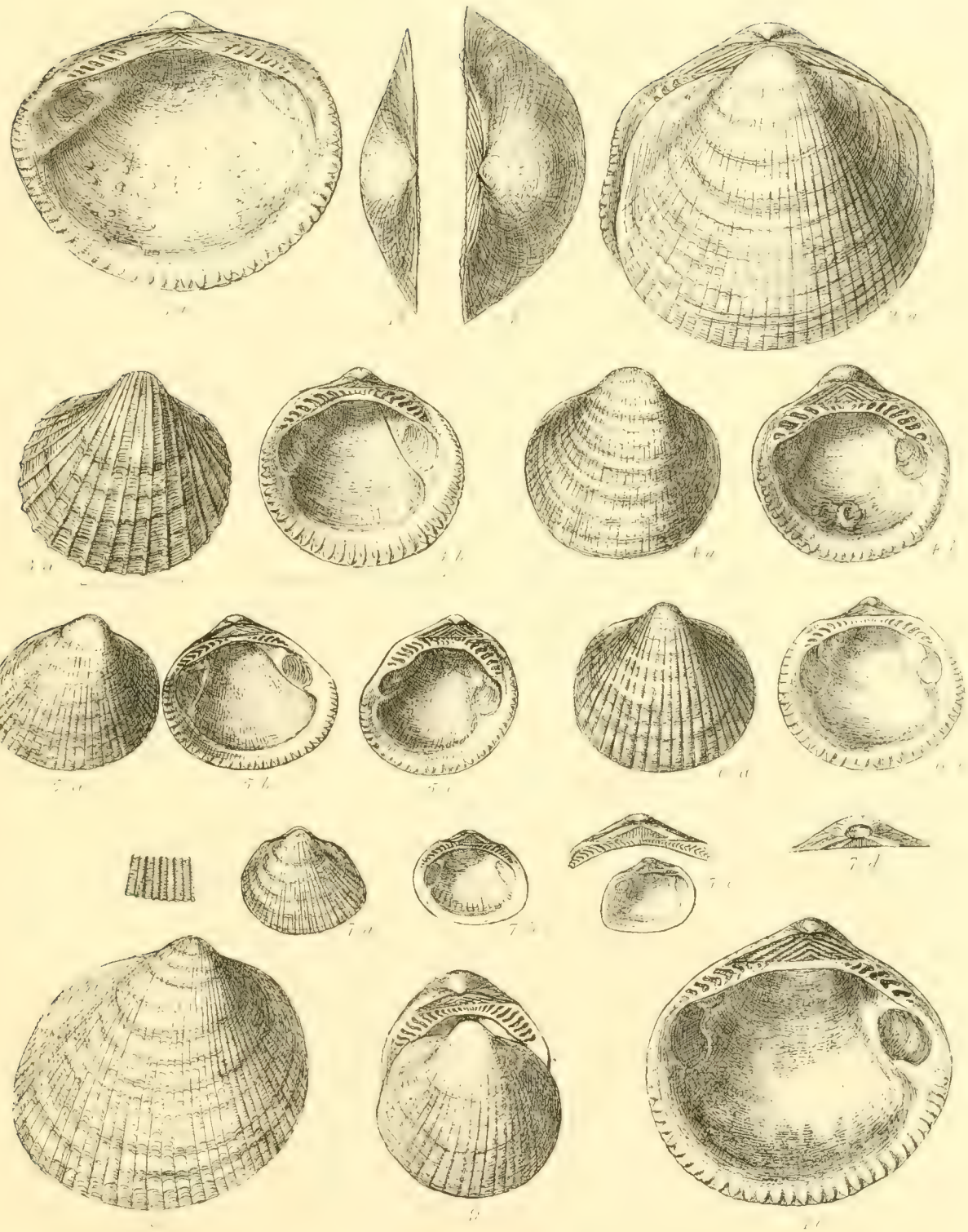


TABLE XVII.

FIG.

1. *a—c.* Leda partim-striata, *page* 129. Mus. Edwards.
2. *a, b.* ,, Galeottiana, *p.* 126. ,,
3. *a, b.* ,, costulata, *p.* 125. ,,
4. *a—c.* ,, prisca, *p.* 128. ,,

   d. ,, — ; from Highgate. Mus. Wetherell.
5. ,, substriata, *p.* 130. Mus. Prestwich.
6. *a—c.* ,, amygdaloides, *p.* 125. Mus. Edwards.
7. *a, b, c.* ,, minima var. *α. gracilis, p.* 127. ,,

   c, d. ,, ,, *β communis.* ,,
8. *b. c.* Cucullæa decussata, *p.* 93. ,,

   a. ,, Mus. Bowerbank.
9. *a, b.* Limopsis scalaris, *p.* 104. Mus. Edwards.
10. *a, b.* ,, granulata, *p.* 103. ,,
11. *a, b.* Pectunculus proximus, *p.* 99. Mus. Fisher.

The lines indicate the size of the specimens.

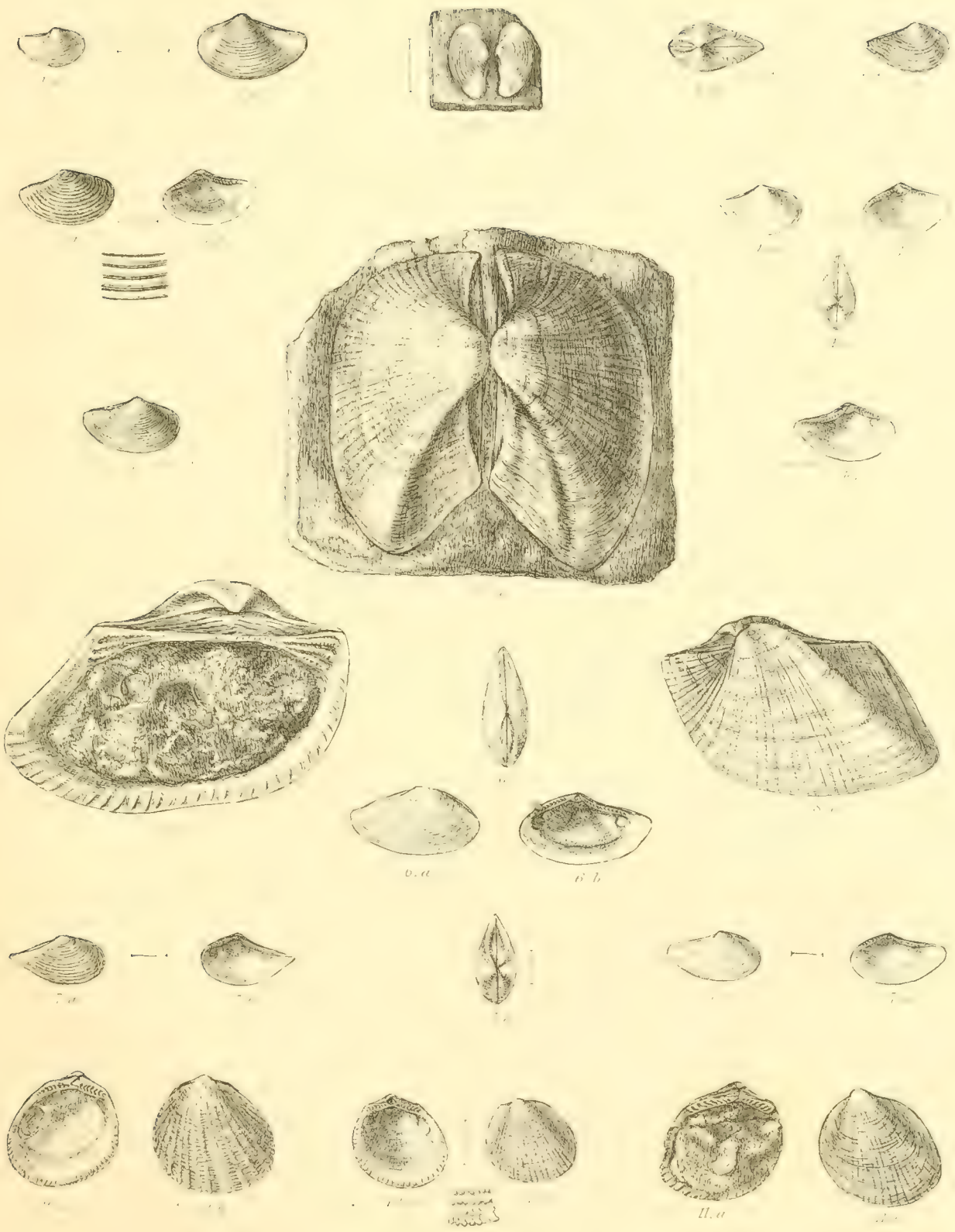

6.a
6.b
11.a

TABLE XVIII.

Fig.

1. *a—c.* Nucula tumescens, *page* 121. Mus. Edwards.
2. „ sphenoides, *p.* 119. „
3. *a, b.* „ Headonensis, *p.* 113. „
4. *a. b.* „ lissa, *p.* 113. „
5. *a, b.* „ ampla, *p.* 108. „
6. *a, b.* „ — var. *contigua*, *p.* 108. „
7. *a—c.* „ Dixoni, *p.* 112 „
8. *a, b.* „ — var. *planiuscula*, *p.* 112. „
9. „ — var. *quadrans*, *p.* 112. „
10. „ minor, *p.* 114. „
11. *a, b.* „ similis, *p.* 118. „
c. „ — var. *trigona*, *p.* 118. „
12. *a, b.* „ curvata, *p.* 112. „
13. *a—c.* „ bisulcata, *p.* 109. „
14. *a, b.* „ Bowerbankii, p. 109. „
15. „ protracta, *p.* 117. „

The lines indicate the size of the specimens.

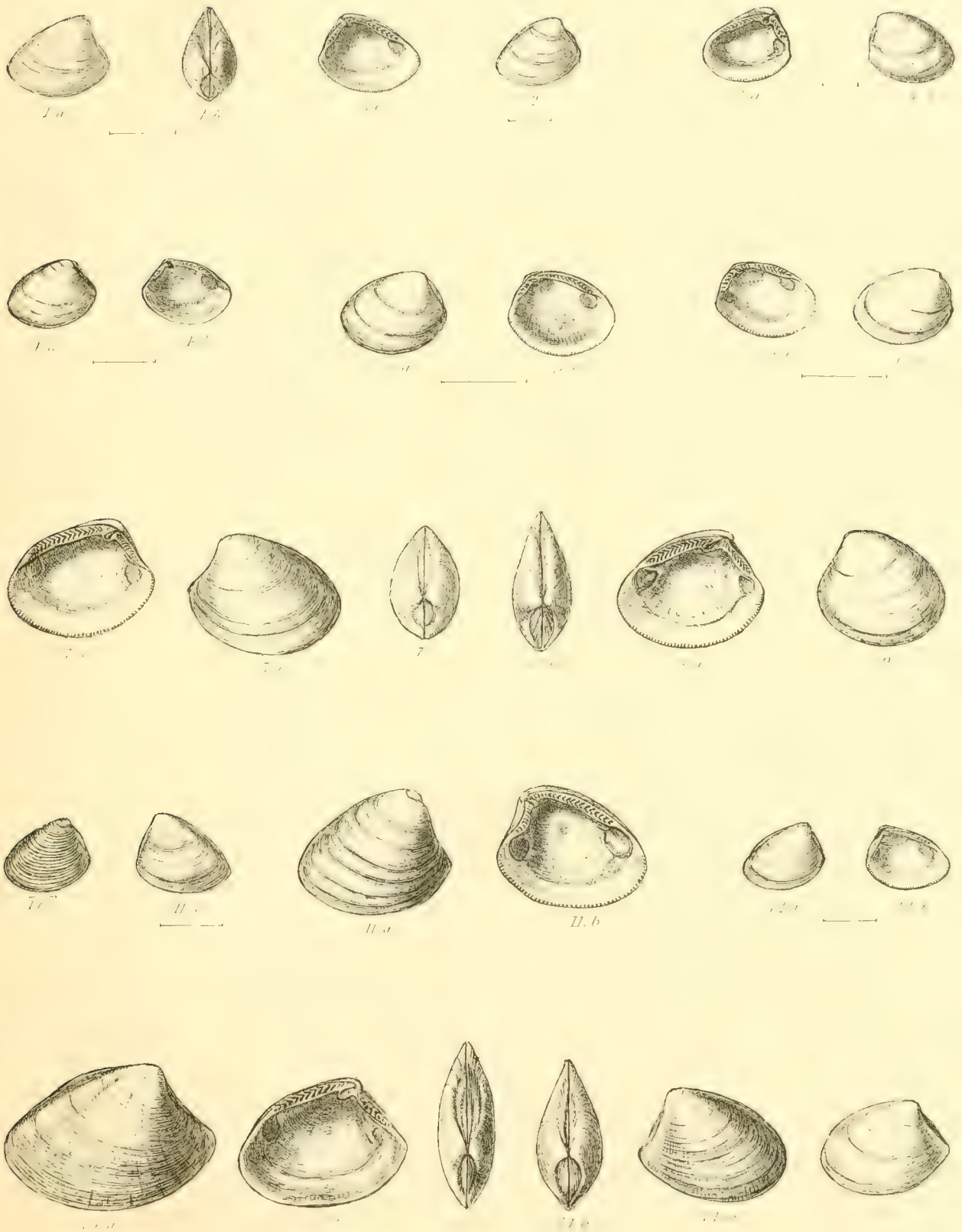


TABLE XIX.

Fig.

1. *a, b.* Nucula prælongata, *p.* 116. Mus. Edwards.
2. *a, b.* „ sphenoides, *p.* 119. „
3. „ sericea, *p.* 120. „
4. *a, b.* „ prælonga, *p.* 115. „
5. „ compressa, *p.* 110. „
6. „ Thanatiana, *p.* 121. „
7. *a, b.* „ consors, *p.* 111. Mus. Wetherell.
8. „ cardioïdes, *p.* 110. Mus. Edwards.
9. *a, b.* „ Wetherellii, *p.* 121. Mus. Wetherell.
10. Leda oblata, *p.* 128. „
11. *a—c.* Trigonocœlia deltoidea, *p.* 105. Mus. Edwards.
12. „ cancellata, *p.* 106. „
13. Nucula subtransversa, *p.* 120. Mus. Fisher.
14. *a—c.* Pectunculus decussatus, juv., *p.* 97. Mus. Edwards.
15. Modiola? subcancellata, *p.* 77.
16. Modiola? crassistriata, *p.* 75. „
17. „ ? consobrina, *p.* 76. Mus. Fisher.
18. „ ? Bartonensis, *p.* 75. Mus. Edwards.
19. „ Deshayesiana? *p.* 76. „
20. „ subcarinata? *p.* 77. „
21. Nucula prælævigata, *p.* 123. „

The lines indicate the size of the specimens.

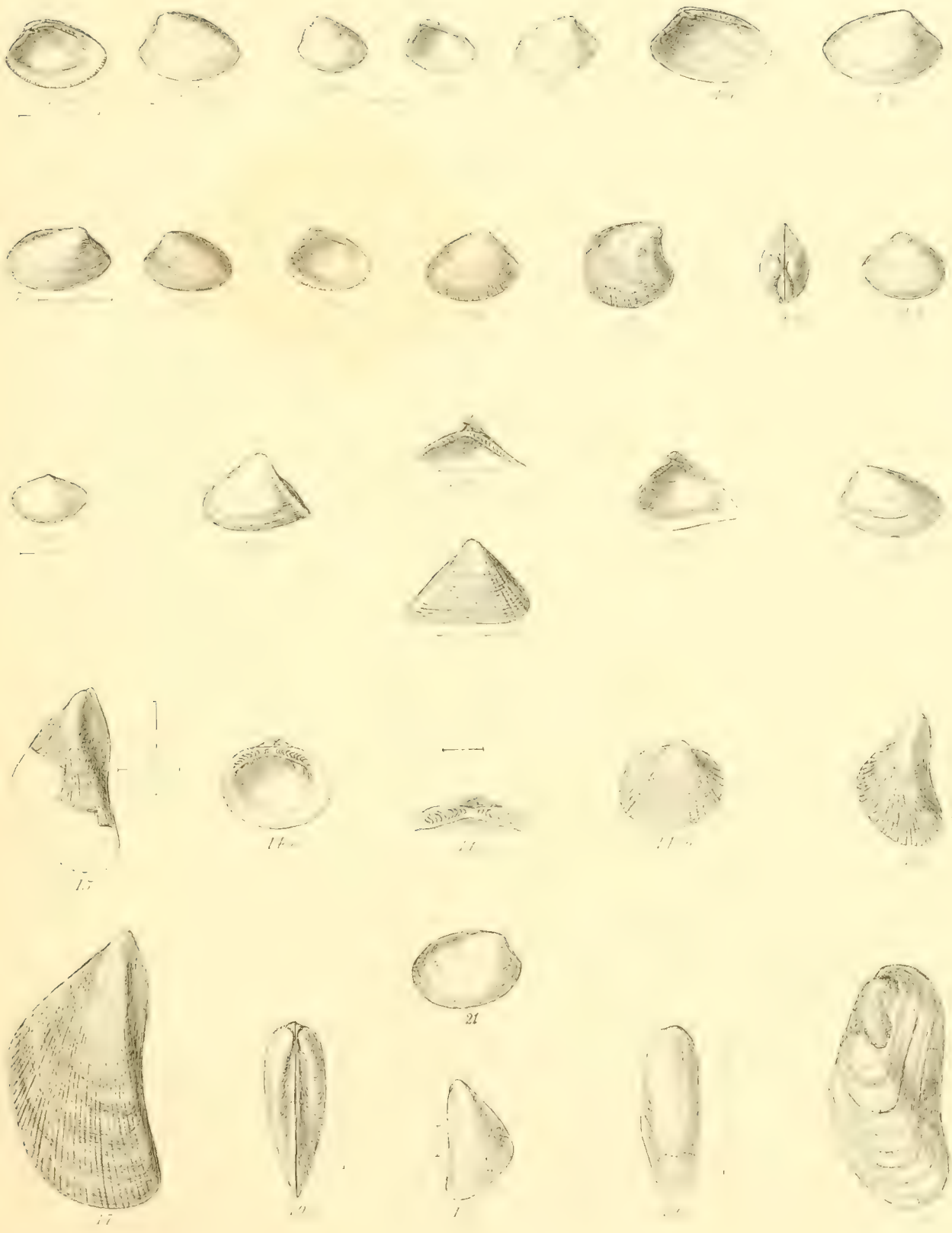


TABLE XX.

Fig.

1. Nucula lissa, *p.* 113. Mus. Edwards.
a. „ — var. *normalis*, *p.* 113. Mus. Edwards.
b. „ — „ *transversa*, „ „
c. „ — „ *abnormis*, „ „
2. Leda propinqua, *p.* 129. „
3. *a*, *b.* Nucula proava, *p.* 117. Mus. Jermyn Street.
4. *a*, *b.* „ nudata, *p.* 115. Mus. Edwards.
5. „ sphenoides, *p.* 119. „ View to show tumidity and anal region.
6. „ gracilenta, *p.* 122. Mus. Meyer.
7. „ consobrina, *p.* 122. Mus. Prestwich.
8. *a.* „ sextans, *p.* 123. Mus. Edwards.
b. id.? *p.* 123. Mus. Jermyn Street.
9. „ striatella, *p.* 123. „
10. „ venusta, *p.* 122. Mus. Prestwich.
11. *a*, *b.* Unio Solandri, *p.* 134. Mus. Edwards.
12. „ Austenii, *p.* 133. Mus. Jermyn Street.
13. „ subparallelus, *p.* 135.
a. Specimen from Counter Hill pits, Deptford. Mus. Prestwich.
b. „ Peckham. Mus. Edwards.
14. „ Gibbsii, *p.* 133. Mus. Jermyn Street.
15. „ — ? var. *Headonensis*, *p.* 133. Mus. Edwards.
16. „ Vectensis, *p.* 136. „
17. *a*, *b.* „ Edwardsi, *p.* 133. „
18. *a*, *b.* „ tumescens, *p.* 135. „
19. Pectunculus terebratularis, *p.* 101. „

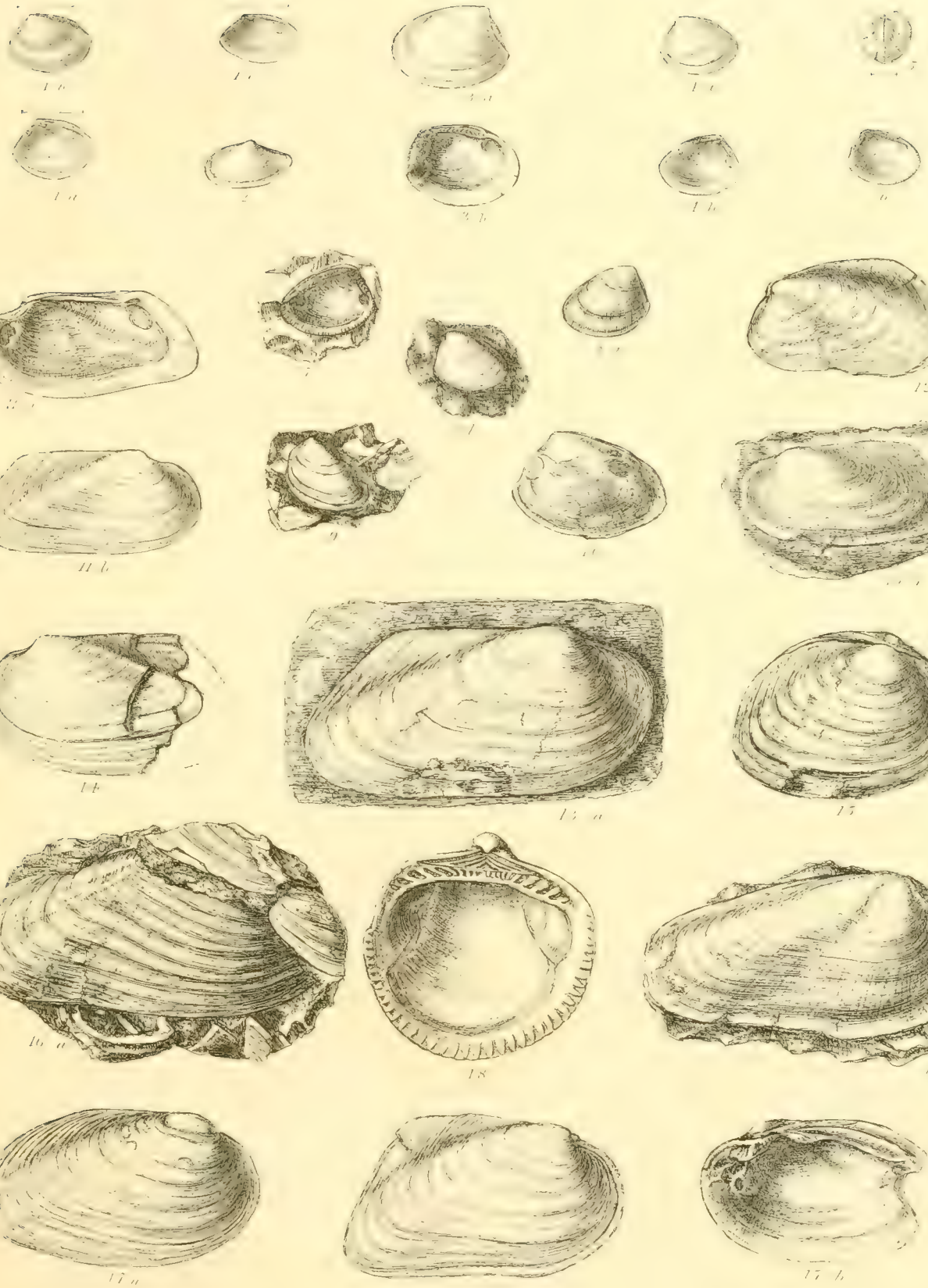


PLATE XXI.

Fig.

1, *a*, *b*. Cardita corpusculum, S. Wood, *p*. 153. Barton.

2, *a*, *b*. Astarte modicella, S. Wood, *p*. 158. Stubbington.

3. Cardita alticostata, S. Wood, *p*. 143. Highgate.

4. „ simplex. Edwards, *p*. 151. Roydon.

5, *a*. „ planicosta. *b*. juv. *c*. var. *angusticardo*. *d*. var. *laticardo*, *p*. 150. Bracklesham.

6, *a*, *b*. Verticordia formosa, S. Wood, *p*. 139. Whetstone.

7. „ propinqua, S. Wood, *p*. 140. Highgate.

8, *a*, *b*. „ obliquata, Edwards, *p*. 139. Bracklesham.

9, *a*, *b*. „ sulcata, J. Sowerby, p. 140. Highgate.

10. Cardita imbricata, Lamarck, *p*. 147. Bracklesham.

11. „ oblonga (var. *trapezoidalis*), *p*. 149. High Cliff.

12. „ simplex, Edwards, *p*. 151. High Cliff.

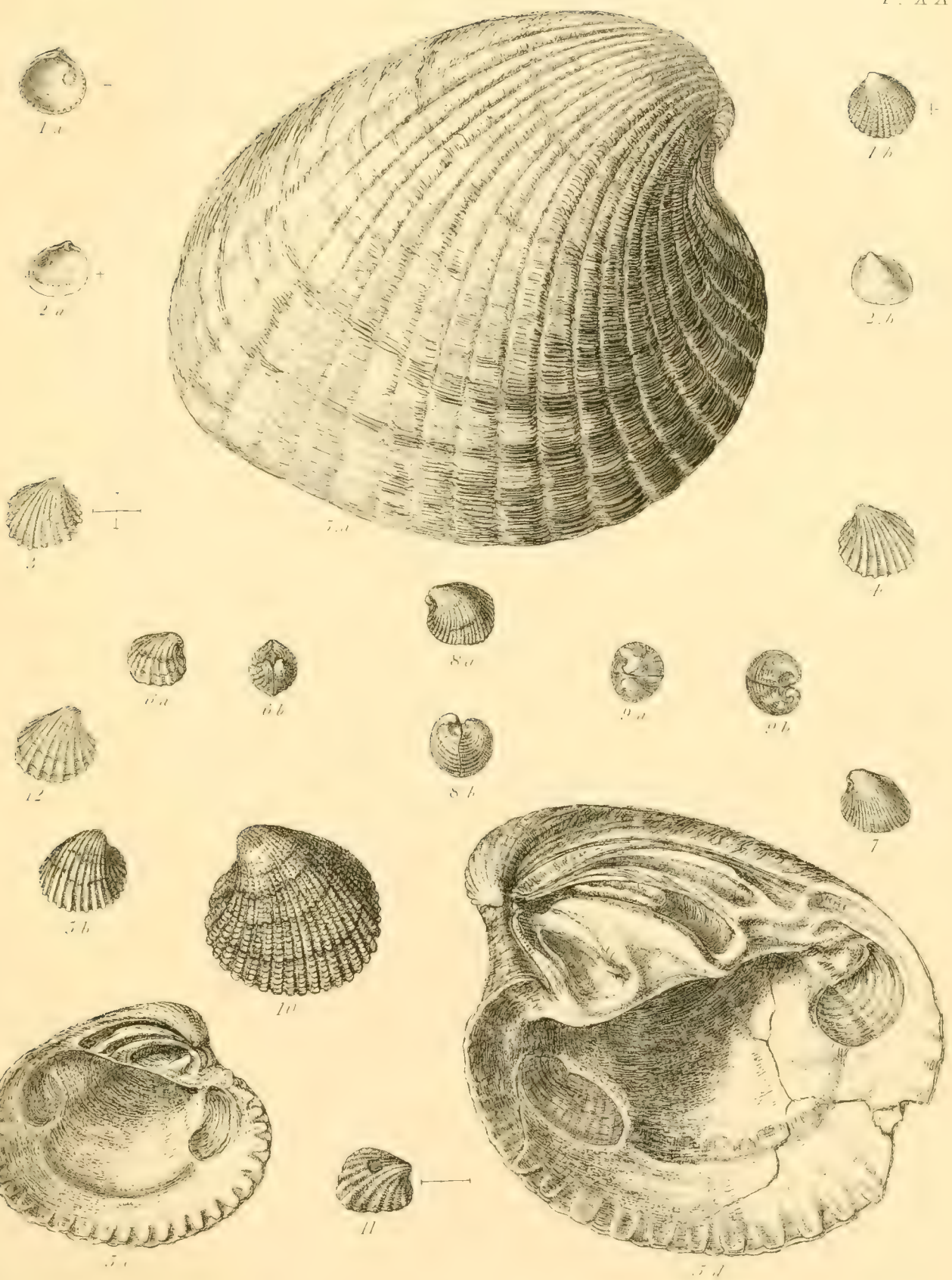
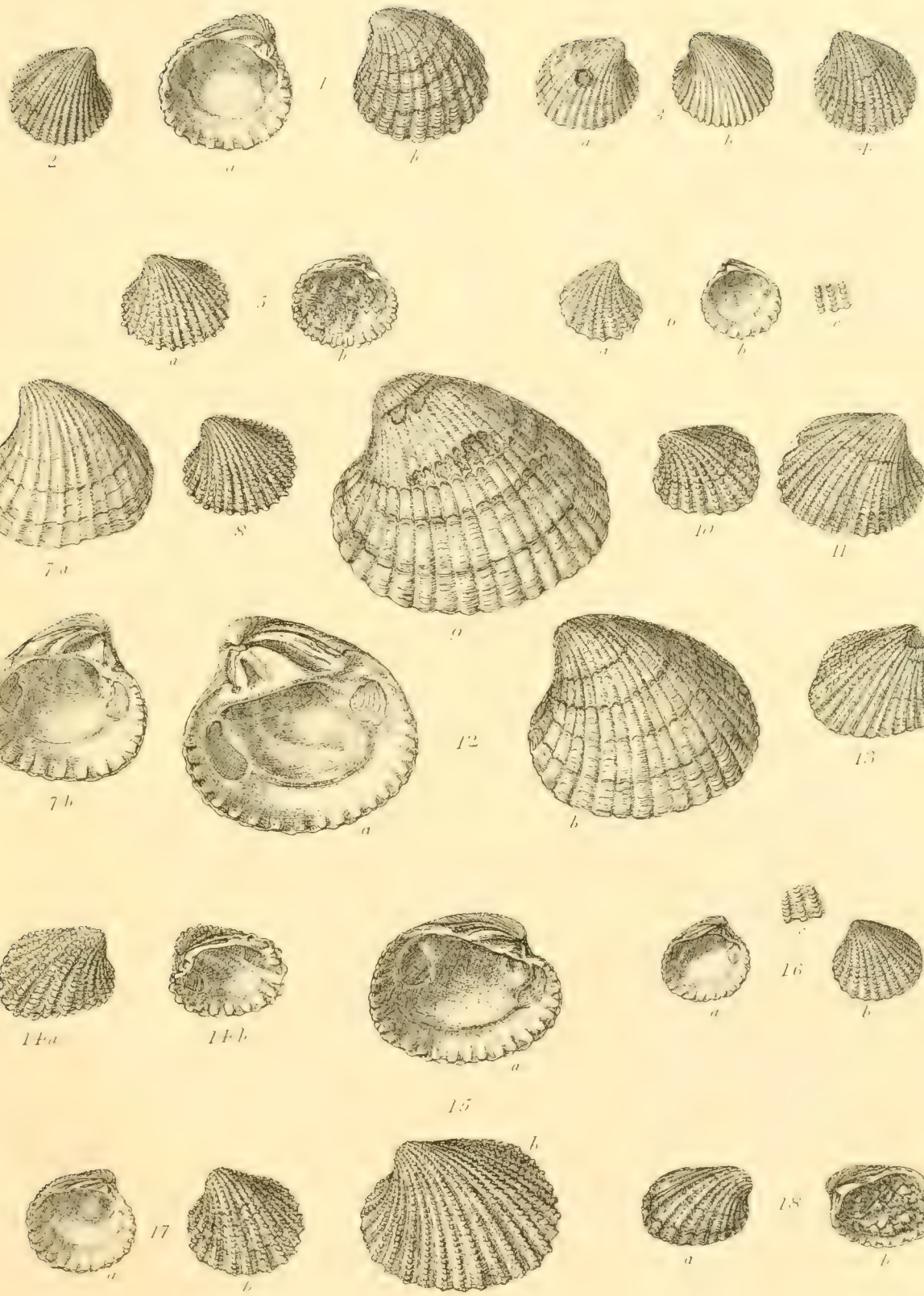


PLATE XXII.

FIG.

1, *a*, *b*. Cardita sulcata, Solander, *p*. 152. Barton.
2. ,, crebrisulcata (var. *subprofunda*), p. 144. Brook.
3, *a*, *b*. ,, mitis? Lamarck, *p*. 147. Bracklesham.
4. ,, crebrisulcata, Edwards, MS., *p*. 144. Bramshaw.
5, *a*, *b*. ,, acuticosta? Lamarck, *p*. 142. Bracklesham.
6, *a*, *b*, *c*. ,, paucicostata, Sandberger, *p*. 149. Headon Hill.
7, *a*, *b*. ,, deltoidea, J. Sowerby, *p*. 145. Lyndhurst.
8. ,, crebrisulcata (var. *subquadrata*), p. 144. Huntingbridge.
9. ,, Brongniartii, Mantell, *p*. 143. Bognor.
10. ,, oblonga (var. *serratina*), *p*. 149. Mead End.
11. ,, acuticostata? (var. *asperrima*), *p*. 142. Bramshaw.
12, *a*, *b*. ,, Brongniartii (var. *Clarendonensis*), *p*. 143. Clarendon.
13. ,, obovata, Edwards, MS., *p*. 148. Bracklesham.
14, *a*, *b*. ,, oblonga, J. Sowerby, *p*. 149. Barton.
15, *a*, *b*. ,, carinata, J. Sowerby, *p*. 144. Bracklesham.
16, *a*—*c*. ,, elegans, Lamarck, *p*. 146. Id.
17, *a*, *b*. ,, Davidsoni, Deshayes, *p*. 145. Barton.
18, *a*, *b*. ,, oblonga (var. *transversa*), *p*. 149. Hordle.


2
a
1
b
a
3
b
4
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a
6
b
c
7a
8
9
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11
7b
a
12
b
13
14a
14b
a
15
16
a
b
17
a
b
b
a
18
b

PLATE XXIII.

Fig.

1, *a*, *b*. Crassatella compressa (var. *hemileia*), Edwards, *p*. 165. Brook.

2, *a*, *b*. ,, tenuisulcata, Edwards, *p*. 171. Barton.

3. ,, sinuosa, Lamarck, *p*. 168. Bracklesham.

4, *a*, *b*. ,, sulcata (var. *gradata*), *p*. 171. High Cliff.

5, *a*, *b*. ,, compressa, Lamarck, *p*. 164. Huntingbridge.

6, *a*, *b*. ,, Sowerbyi, Edwards, *p*. 169, Stubbington.

7, *a*, *b*. ,, sulcata (var. *ensiformis*), *p*. 170. Barton.

8, *a*, *b*. ,, Grignonensis, Deshayes, *p*. 166. Bracklesham.

9. ,, sinuosa? Lamarck, *p*. 168. Barton.

10, *a*, *b*. ,, Grignonensis (var. *Anglica*), p. 166. High Cliff.

11, *a*—*c*. ,, sulcata, Solander, *p*. 170. Barton.

12, *a*, *b*. ,, subquadrata, Edwards, *p*. 169. *a*. White Cliff Bay. *b*. Barton.

13, *a*—*c*. ,, Sowerbyi (var. *Hantoniensis*), *p*. 169. Brockenhurst.

14, *a*, *b*. ,, plicata, J. Sowerby, *p*. 167. Bracklesham.

15, *a*—*c*. ,, gibbosula, Deshayes, *p*. 165. Bracklesham.

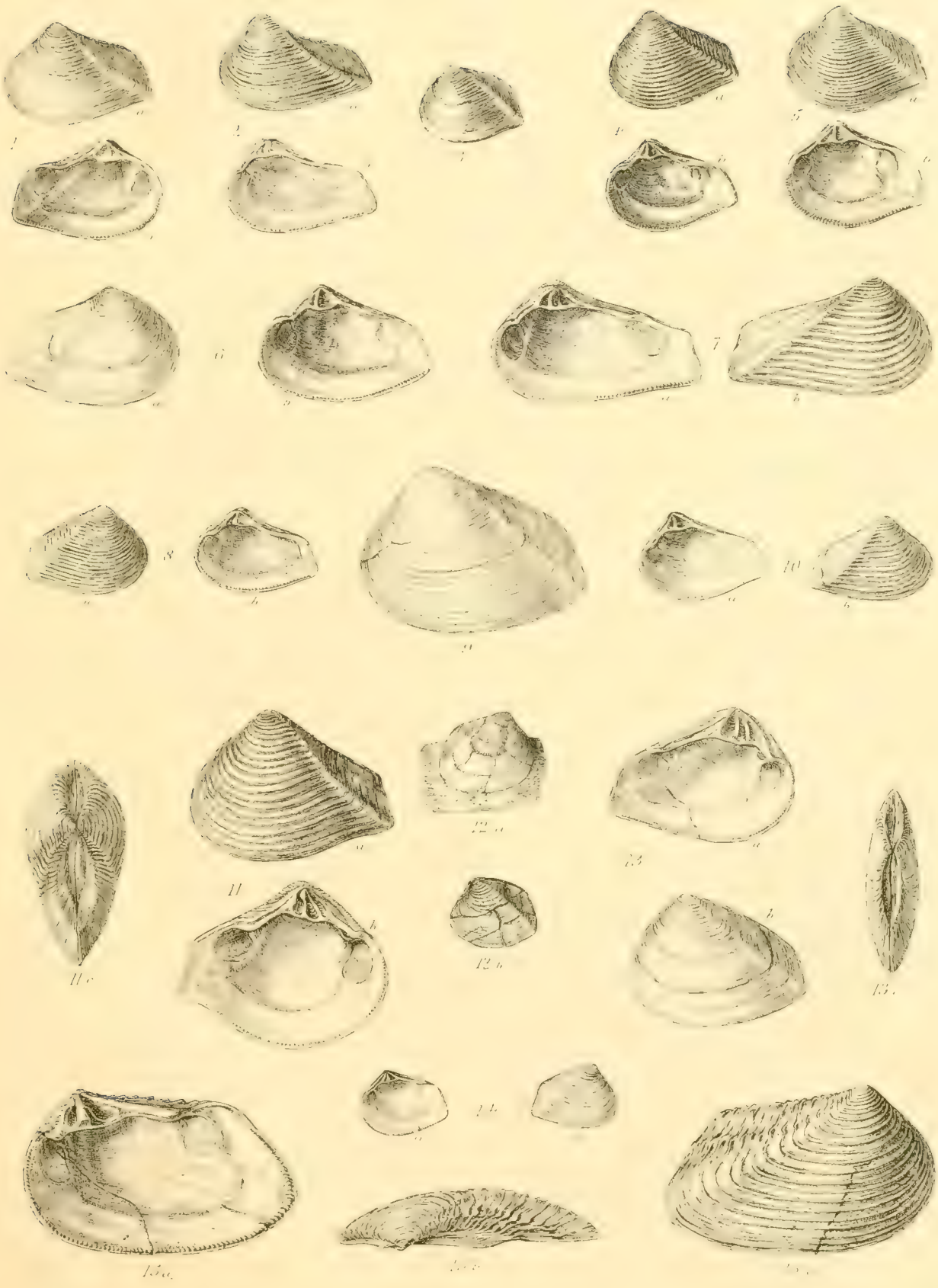

PLATE XXIV.

FIG.

1. Crassatella pumilio, S. Wood, *p.* 168. High Cliff.
2, *a—c.* „ Bronnii? Merian, *p.* 163. Barton.
3. „ corbuloides, Edwards, *p.* 164, Stubbington.
4. „ Bronnii? (var. *æqualis*), *p.* 164. Barton.
5. „ „ ? (var. *tumescens*), *p.* 164. Stubbington.
6, *a, b.* „ tenuisulcata (var. *lineatissima*), *p.* 171. Bramshaw.
7, *a, b.* „ Bartonensis, Edwards, *p.* 163. Barton.
8. Astarte tenera? (var. *Hampsteadiensis*), *p.* 158. Hampstead.
9. „ rugata (var. *filigera*), *p.* 157. Id.
10, *a. b.* „ donacina, J. Sowerby, *p.* 156. Old Basing.
11, *a, b.* „ rugata (var. *subrugata*), *p.* 157. Alum Bay.
12. Crassatella Grignonensis (var. *planiuscula*), *p.* 167. Bracklesham.
13, *a—f.* Astarte rugata, J. Sowerby. *a—f.* Sheppey. *d.* Potter's Bar, *p.* 156.
14, *a—c.* „ tenera, J. Sowerby, *p.* 156. Herne Bay.
15. Crassatella Sowerbyi (var. *semi-lævis*), *p.* 169. Bracklesham.
16, *a, b.* „ „ („ *obesa*), p. 169. Stubbington.
17, *a, b.* Astarte Clarendonensis, Edwards, *p.* 155. Clarendon.

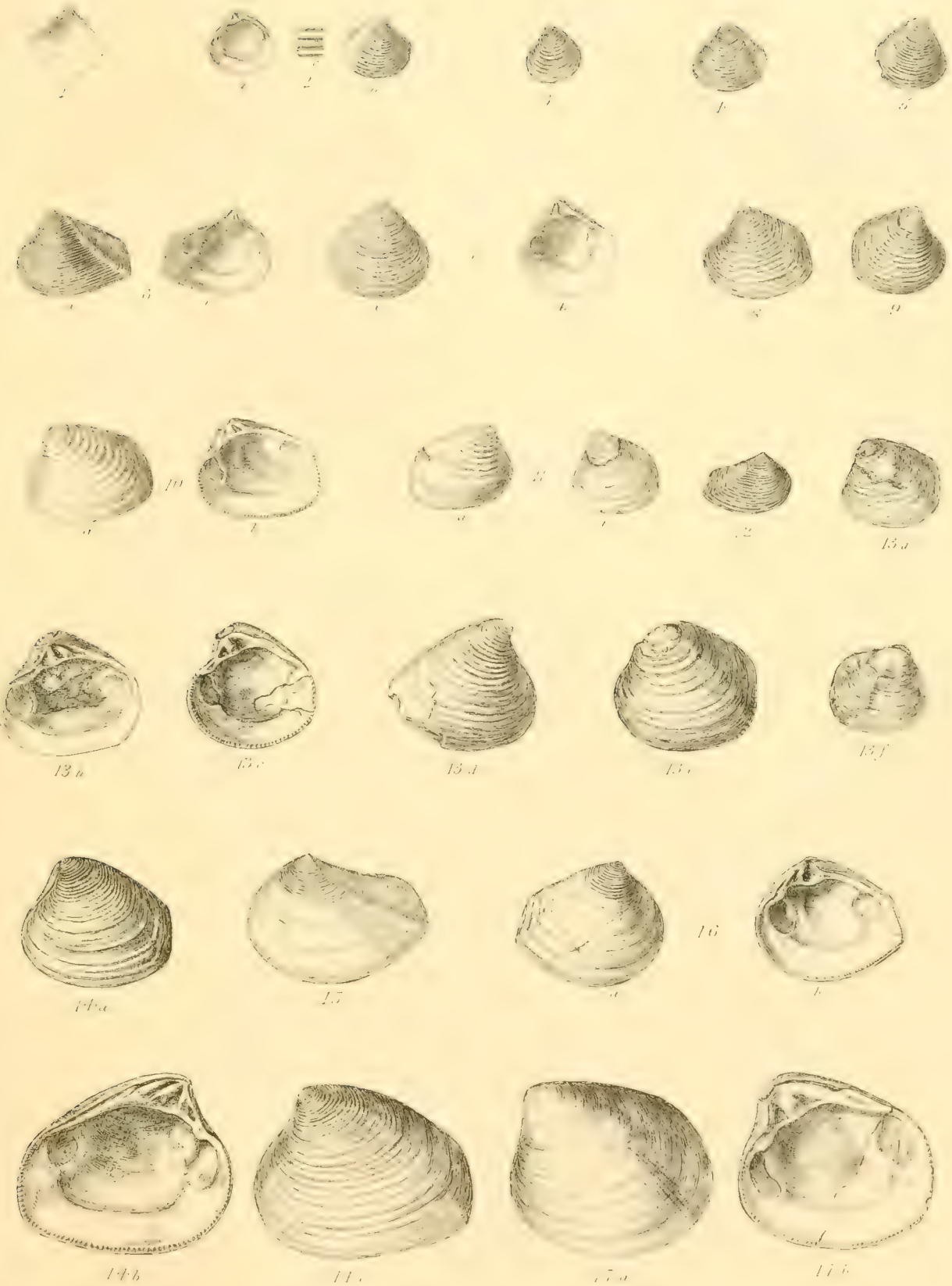

PLATE XXV.

Fig.

1, *a—c.* Chama calcarata, Lamarck, *p.* 172. Bracklesham.

2, *a, b.* ,, gigas, Deshayes, *p.* 174. Id.

3, *a, b.* ,, ,, papyracea? *p.* 174. Id.

4. ,, ,, plicatella? *p.* 174. Id.

5. ,, Selseyensis, Edwards, *p.* 176. Id.

6, *a—d.* ,, squamosa, Solander, *p.* 175. Barton.

7. ,, sulcata? Deshayes, *p.* 175. Bracklesham.

8. ,, fimbriata? Defrance, *p.* 173. Id.

9, *a—c.* ,, turgidula? Lamarck, *p.* 176. Barton.

10, ,, prisca, S. Wood, *p.* 177. Finchley.

11. Woodia crenulata, Deshayes, *p.* 160. Barton.

1a
2a
2b
3a
3b
1b
4
5
1c
6b
7
6a
9a
9b
6d
6c
8
9c
10
11

A MONOGRAPH

OF THE

EOCENE BIVALVES

OF

ENGLAND.

BY

SEARLES V. WOOD, F.G.S.

VOLUME I.

SUPPLEMENT.

Pages 1—24; Plates A and B.

LONDON:
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1877.

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PREFACE.

When I agreed to assist my deceased friend F. E. Edwards in the task of describing the British Eocene Mollusca by taking the Bivalve portion, it was on the understanding that the specimens in his collection (which embraced with few exceptions all the species known from this Formation) should be placed in my hands, to be retained by me so long as they might be required for examination and description, so that I might have them constantly under my own eye for study and for comparison with the figures of the French Eocene species and other published figures accessible to me. The failure of Mr. Edwards's health put an end to the further prosecution of his portion of the work, viz. the Cephalopoda and Gasteropoda, but I was enabled, by the means I have mentioned, to issue another instalment of the Bivalvia in the volume of the Palæontographical Society for 1870. Since then the collection has passed into the British Museum, and by this the desideratum which I considered indispensable for the performance of my part of the work became unattainable. I therefore gave up the idea of further prosecuting the description of the British Eocene Bivalvia; but finding that I had in my own cabinet several species of Eocene Fluviatile Shells which had not been described, and being kindly assisted by Messrs. C. J. Meyer, Caleb Evans, and the Messrs. Bott, with the loan of specimens from their cabinets, I essayed to complete so much of the work as would comprise the Fluviatile species of the Bivalvia, and with that object the accompanying two plates were engraved. Domestic trouble obliged me, however, to postpone even this part of the work, and I now find that, owing to my advanced age and to the infirmity under which I labour, I am incapable of leaving home and spending the time necessary for the thorough study of the species in the British Museum which is essential to their satisfactory description. I have therefore, with much regret, given up the idea of further describing the British Eocene Bivalve Mollusca, and leave its completion to younger and abler hands, confining myself to a description of the few species which have been thus engraved, and trusting that, under the circum-

stances, what I have mentioned will be received as a sufficient excuse for the incomplete state in which I am compelled to leave the subject. My thanks are due to Mr. Henry Woodward, F.R.S., of the British Museum, in whose custody Mr. Edwards' collection now is, for great facilities afforded me in the production of the present small contribution to the British Eocene Mollusca.

S. V. WOOD.

November, 1876.

SUPPLEMENT TO THE EOCENE BIVALVIA.

UNIO. *Phillippson*, 1788.

For generic character see ' Eocene Mollusca (Bivalvia),' Vol. I, p. 130.

Seven species of this genus were figured and described by myself in the Volume of the Palæontographical Society's Publications issued for the year 1862, and I have here introduced the figure of another form. Some of these were not in perfect condition, and will require confirmation by better specimens than any I have seen; indeed, one of these shells figured and described under the name of *Unio Edwardsii*, p. 133, T. XX, f. 16, *a b*, very doubtfully belongs to that genus, the cast only with a mutilated specimen being all that I had seen; but they were so called in Mr. Edwards's cabinet, and I did not feel justified in altering their names, as from their shape I thought they might belong to the genus *Unio*. Another specimen has been obtained from the same formation and locality by Mr. C. Meyer, but as this has only the exterior exposed, I am still doubtful as to its generic position. It was referred to *Cyrena* by Mr. Meyer, but with a doubt, and as I am inclined to think, in the absence of a view of the hinge which the nature of the matrix rendered impracticable, that Mr. Meyer's view of the genus is the more probable, I have figured it under the generic name of *Cyrena* (Tab. A, fig. 15), so that if future specimens should confirm the reference, *Unio Edwardsii* must be expunged from the list of Eocene Mollusca.

The genus *Anodonta* does not so far as I know make its appearance in the Lower Tertiaries of England, and only two species are given by M. Deshayes from the Paris Basin; these do not appear to be well established, and the exterior only has he represented (see his description, An. s. Vert. du Bas. de Par., vol. i, p. 800).

Unio Michaudi ? *Deshayes*. Tab. A, fig 6.

Unio Michaudi, *Desh.* An. sans Vert. du Bas. de Par., p. 802, pl. lxii, figs. 1—5, 1860.
— — ? *Sandberger.* Land- und Süssw.-Conch., p. 177, pl. viii, fig. 1 (cop. Desh.), 1872.

Spec. Char. "*U. Testâ variabili, ovato-rotundatâ, plus minusve inflato-gibbosâ, valde inæquilaterali, transversim irregulariter rugosâ, inæqualiter bis terve undato-gibbosa, sæpius postice plicis tenuibus, divaricatis ornatâ; umbonibus magnis, tumidis, prominentibus, sub-*

cordatis; lunulâ excavatâ, ovato-oblongâ; latere antico brevi, late obtuso, postico oblique truncato; cardine crasso, unidentato, altero inæqualiter bidentato; dentibus crassis triangularibus; irregulariter sulcatis; cicatriculâ musculari anticâ profundâ." (*Deshayes.*)

"*Var.* β. *Testâ suborbiculari, inflato-cordatâ.*

Var. γ. *Testâ brevi, subquadratâ, postice transversim vel paulo obliquè truncatâ.*

Var. δ. *Testâ ovato-oblongâ, postice truncatâ.*

Var. ε. *Testâ ovatâ, paulo arcuatâ postice magis elongato-attenuatâ.*

Length $2\frac{1}{2}$ inches; *height* $1\frac{1}{2}$ inches.

Localities. Britain: Dulwich. (*Meyer.*)
France: Cuis. (*Deshayes.*)

The specimen of this genus from the Lower Eocene of Dulwich, of which the figure above referred to is a representation, was obligingly sent to me for examination by Mr. C. J. Meyer, with the name of *U. Solandri*? written upon it; but I think that it can hardly be referred to that species. The specimen is a cast of the interior with a very small portion of the shell remaining, and the form is so different from that of *Solandri*, and approaches so closely to the second variety described by M. Deshayes of the very variable species *Michaudi*, that I have so referred it provisionally. The shell figured by myself under the name of *U. subparallelus* (Eocene Moll., T. XX, f. 13) appears to be proportionally so much longer that I think our present specimen must belong to a different species. The true determination of some of the recorded Lower Eocene shells of this genus will require better specimens than any I have seen, but I doubt much if any that I have seen can be correctly referred to *Unio Solandri*, although in this genus especially we are confronted with more than ordinary variation, when we consider the enormous amount of synonyms that have been given by Mr. Lee to some of the living British species (see 'Eocene Bivalves,' p. 131). Our present shell is not very far removed from the recent species *Unio complanatus*.

Dreissena serrata, Melleville ('Sables Tert. inférieurs, p. 40, pl. 1, f. 11, 12), is inserted in the List given by Mr. Whitaker in his memoir, p. 577, as from the Woolwich and Reading series, but for this no special locality is given, and I have not been able to see a specimen to justify the name. This was inserted by him, he informs me, on the authority of Mr. Prestwich's list in 'Quart. Jour. of the Geol. Soc., vol. x, p. 117, wherein Mr. Prestwich says that the specimen on which the name is inserted by him was too imperfect to admit of a positive determination.

CYRENA. *Lamarck.*

Generic Character. Shell equivalved, roundedly trigonal, ovate, or transverse, more or less inequilateral, generally thick and strong: hinge with two cardinal teeth in each valve and a large extended lateral tooth on both sides; exterior generally smooth or

irregularly ridged by simple lines of growth. Connexus ligamentous; impression by the mantle with scarcely a perceptible sinus.

This genus is closely connected with *Cyclas*, but it differs in having a thick and heavy shell. Its habitation, like the latter, is for the most part in fresh water, although it is found in estuaries in association with Oysters and *Littorinæ*. In the recent state it is known only in tropical or subtropical regions, although one species, a remnant of this race, flourished in Britain during the Crag and earlier part of the Glacial, and again in the Post-glacial period, but I am not aware of any of the older Tertiary species having survived to the present day. In the Quart. Jour. Geol. Soc. for 1850, vol. vi, p. 444, *Cyrena trigonula*, Wood, the Crag and Post-glacial species just referred to (*C. fluminalis*, Müll.) is quoted by Mr. De la Condamine as having been found at Charlton in association with *C. cuneiformis*, *Melania inquinata*, &c. I have not, however, been able to see the specimen so referred by him, and think that the species referred to must have been that described (postea p. 190) as *C. trigona*, Desh. *C. Gravesii* is also given by the same author; but I have been equally unable to identify that reference by any British specimen, and Mr. Whitaker's notice of the same species in his list, page 577 of the 'Geol. Survey Memoir,' vol. iv, is, he informs me, inserted on the authority of Mr. De la Condamine's paper only.

Cyrena as proposed by Lamarck has been separated into numerous sections or subgenera, but most of these divisions appear to me to be no more than might be expected between species. Dr. Gray proposed the name of *Corbicula*, to include those species which have elongated lateral teeth, striated in a transverse direction and a somewhat imbricated exterior, taking *Tellina fluminalis*, Müller, as the type; retaining *Cyrena* for those species in which these teeth are not striated, and *Batissa*, Adams, for some intermediate forms. Several other divisions have also been made, but as I agree with M. Deshayes in thinking that all the various forms of Bivalves possessing two cardinal teeth and two more or less elongated laterals found in the Lower Tertiaries belong to one genus, *Cyrena*, I have followed his arrangement.

1. Cyrena crassa? *Deshayes.* Tab. A, fig. 10 *a*, *b*.

Cyrena crassa, *Desh.* Coq. Foss. des Env. de Par., p. 119, pl. xviii, figs. 14, 15, 1824.
— (corbicula) crassa, *Sandberger.* Land- und Süssw.-Conch., p. 252, t. xiv, figs. 4, 4 *b*, 1872.

Spec. Char. C. Testâ crassâ, cordiformi, sublævigatâ, nitiaulâ; umbones parvuli, submediani; lunulâ parvâ, paulo profundâ, obsoletè circumscriptâ; dentes cardinales bini bifidi et unicus simplex, nec non laterales inæquales, crenulis rectis plicatuli in utráque valvâ extant. Impressione pallii breviter sinuosâ.

Length, $\frac{9}{16}$ths of an inch; *height*, $\frac{3}{8}$ths of an inch.

Localities. Britain: Peckham and Sundridge Park.

France: Damery, Auvers, &c.

A few specimens have been sent to me by Mr. C. Meyer with the name of *Cyrena intermedia*, Morris. They are much more rounded than any of that species in my possession, and appear to correspond with M. Deshayes' figures and descriptions of *crassa*, to which I have accordingly referred them with a mark of doubt. M. Deshayes gives his species as from the Upper beds.

This possibly may be the shell that has been called *Cyrena obovata?* Sowerby, in Mr. Whitaker's List ('Mem.,' p. 577) from Dulwich, of the Woolwich and Reading series. Possibly, also, the shell figured by Jas. Sowerby, 'Min. Conch.,' Tab. 162, fig. 4, as from New Cross, may be the same as the above.

2. Cyrena cordata, *Morris*. Tab. A, fig. 2 *a—c*.

Cyrena cordata, *Morris*. Geol. Journ., vol. x, p. 158, t. xi, figs. 7—9, 1854.

Spec. Char. "*C. Testâ subtrigonali, crassâ, gibbosâ, rugosâ; umbonibus prominentibus; antico rotundato, postico subrostrato, depresso, attenuato.*" (*Morris.*)

Length, $1\frac{1}{2}$ an inch; *height*, $1\frac{3}{8}$ths of an inch.

Localities. Dulwich, New Cross, Charlton. (*Meyer.*)

Numerous specimens of this species have been found, and several in a good state of preservation have been obligingly sent to me for examination by Mr. C. J. Meyer, some from Dulwich and others from Sundridge Park. In general they maintain a great uniformity of character, being tumid in the pedal region, but compressed on the other side, with a slightly angular slope on the posterior margin, and a projection at the exit of the siphons. This shell is covered generally with concentric ridges or prominent lines of growth, but I am unable to say whether these are regularly thickened striæ, or whether they are the result of irregular decortication, as some specimens are smooth or nearly so. Many of these specimens have from three or four to a dozen rays proceeding from the umbo to the ventral margin, and these rays appear to have been formed from the loss of surface. Probably they were in the living state strongly coloured like some of the *Veneridæ*, or like the freshwater shell *Galatea radiata*, and that the coloured matter caused the unequal decomposition of the surface where they existed. This is not very unlike another well-known shell in respect to these rays, viz. *Gnathodon cuneatus*, which inhabits brackish water near Mobile, in the Gulf of Mexico, where it is profusely abundant in association with *Cyrena Carolinensis*.

Our shell is usually uniform in outline, but all that I have seen have the siphonal side more or less compressed, with a prominent and slightly angular termination.

3. Cyrena cuneiformis, *J. Sowerby*. Tab. A, fig. 3 *a*—*c*.

Cyclas cuneiformis, *J. Sow.* Min. Conch., t. 162, figs. 2, 3, 1817.
Cyrena — *Desh.* Coq. foss. des Env. de Par., vol. i, p. 122, pl. xix, figs. 1, 2, 20, 21, 1824.
— — *Sandb.* Land- und Süssw.-Conch., p. 181, t. viii, figs. 6 *a*, *b*, 1872.
— — *Morris.* Catal. Brit. Foss., 2nd edit., p. 199, 1854.
— — *J. Lowry.* Chart. Brit. Tert. Foss., pl. iv, 1866.
— donacialis, *Desh.* Dict. Class. d'Hist. Nat., t. v, p. 290, 1824.

Spec. Char. C. Testâ transversâ, trigonulâ, inæquilaterali, irregulariter substriatâ; anticè truncatâ, posticè angulatâ; dentibus cardinalibus tribus, dentibus lateralibus inæqualibus perpendiculariter rugosis aut striatis.

Length, $\frac{15}{16}$ths of an inch; *height*, $\frac{5}{6}$ths of an inch.

Localities. Britain: Charlton, New Cross, Dulwich.
France: Lignites, and Sables moyens.

This is an abundant species in the Woolwich beds of this country; and it is said by M. Deshayes to be profusely spread in the Lignites and Sables moyens in France. The locality of Headen Hill is given in the 'Coq. Fos. des Env. de Par.,' Tab. 1, p. 123, but I have not been able to see a specimen of this species from the Isle of Wight, nor have I heard of its having been found there. Possibly *C. semistriata* may have been mistaken for it. The impression by the mantle exhibits a small and shallow sinus.

The variation in this species consists in an extension of the siphonal side, one variety being more inequilateral than the other. It somewhat resembles the recent species *Cyrena Floridensis*.

4. Cyrena strigosa, *S. Wood*. Tab. A, fig. 4.

Spec. Char. C. Testâ transversè trigonatâ, inæquilaterali, regulariter circinatâ vel striatâ, striis magnis acutis, anticè rotundatâ, posticè angulatâ elongatâ; dentibus cardinalibus tribus, dentibus lateralibus striatus.

Length, $1\frac{3}{8}$ths of an inch nearly; *height*, $\frac{3}{4}$ths of an inch nearly.

Locality. Charlton. (*S. Wood.*)

This species is equally abundant with *C. cuneiformis*. It has the exterior covered with regularly concentric striæ or ridges, rounded and distinct; whereas in *cuneiformis* the lines of growth are indistinct or irregular, and sometimes scarcely perceptible; and these differences appear to me to justify a specific separation. The angular ridge over

the siphonal or posterior side also is rather more distinct than in *cuneiformis*, and the anterior lateral tooth is rather narrower and more elongated; but the ornamented exterior is the principal character that seems to justify its being placed in a separate specific position.

5. Cyrena Forbesii, *Deshayes*. Tab. A, fig. 5 *a*, *b*.

Cyrena Forbesii, *Desh.* An. sans Vert. du Bas. de Par., t. i, p. 510, pl. xxxvii, figs. 24—27, 1860.

Spec Char. C. Testâ ovato-trigonâ, subtransversâ, inæquilaterali, turgidulâ, posterius depressâ, obtusè angulatâ, transversim obsoletè striatâ; umbonibus prominentibus obliquis; latere antico rotundato, postico acuminato; cardine inæqualiter tridentato, dentibus divaricatis; dentibus lateralibus crassis inæqualibus.

Length, 1⅛th of an inch; *height*, 1 inch.

Localities. Britain: Charlton. (*S. Wood.*)
France: Sainceny.

This has been separated, and I think justly, by M. Deshayes from *Cyrena antiqua*, Ferussac. Speaking of *C. antiqua*, however, M. Deshayes says ('An. sans Vert. du Bas. de Par.,' tom. 1, p. 510) that "M. Hébert en a recueilli de nombreux échantillons dans les environs de Dieppe; elle est egalement en abondance dans les Lignites de Woolwich en Angleterre." This statement is, I think, an error as far as Woolwich is concerned, for I have not been able to see the true *antiqua* from our own beds.

My researches in the Woolwich beds at Charlton were confined to a large excavation that was open when I hunted it fifty years ago, and I have not since visited it. My specimens have, however, ever since been carefully kept with the localities attached, and I give them as undoubtedly genuine.

6. Cyrena Dulwichiensis, *Rickman*. Tab. A, fig. 14 *a*—*c*.

Cyrena Dulwichiensis, *Rickman.* Quart. Jour. Geol. Soc., vol. xvii, p. 6, 1861.
— — *Edwards.* Geologist, p. 210, pl. v, figs. 4, 5, 1860.
— — *J. Lowry.* Chart. Brit. Tert. Foss., pl. iv, 1866.

Spec. Char. C. Testâ oblongo-transversâ, crassiusculâ, inæquilaterali, lævigatâ vel obsoletè striatâ; umbonibus minimis depressis vix obliquis; dentibus cardinalibus tribus, lateralibus inæqualibus, elongatis, angustis, tenuissime striatis.

Length, 2 inches; *height*, $1\frac{1}{4}$ inches.

Locality. Dulwich.

Several specimens of this species have been put into my hands by Mr. Meyer and Mr. C. Evans, but they have all the valves united, or have the shell embedded in the matrix so as not to exhibit clearly the dental furniture, or impressions by the muscles. Mr. Meyer has, however, so far cleared the hinge of a left valve as to show that it has two unequally elongated, lateral teeth, with what seem to be two triangular, cardinal denticles, and a ledge for an external or ligamentous connector; so that we can confidently place it as a *Cyrena*. The large specimen which I have had figured, and which belongs to Mr. Meyer, is smooth; but there are two nearly obsolete rays. In other specimens, however, these rays are more numerous, and vary from 6 to 10.

I have given representations of some different forms. One of these has the posterior or siphonal side somewhat pointed, and another has this side broader, and the shell is nearly cylindrical, the posterior side being as broad or high as the anterior.

A full description of this species was given by Mr. Edwards, as above referred to.

7. Cyrena intermedia? *Melleville.* Tab. A, fig. 8 *a*, *b*.

Cyrena intermedia, *Mellev.* Sab. Tert. infér. Bas. de Par., p. 35, pl. ii, figs. 5, 6, 1843.
— — *Prestwich.* Quart. Journ. Geol. Soc., vol. x, p. 155, pl. ii, figs. 10, 11, 1854.
— — ? *Desh.* An. sans Vert. du Bas. de Par., p. 514, pl. xxxviii, figs. 19, 20, 1860.
— (Loxoptychodon) intermedia, *Sandberger.* Land- und Süssw.-Conch., p. 163, t. x, fig. 3, 1872.

Spec. Char. C. Testâ transversâ, oblongo-subtrigonâ, inæquilaterali, obsoletè transversim striatâ; umbonibus prominulis obliquis, cardine tridentato, dentibus lateralibus subæqualibus, striatis.

Length, $\frac{3}{8}$ths of an inch.

Localities. Britain: Charlton (*S. Wood*), Sundridge (*Meyer*).
France: Lignites.

This shell corresponds with the one given by Mr. Prestwich, as above referred to; but I agree with him that its identity with the shell figured and described by Melleville is doubtful, as Melleville's figure represents a larger shell with a narrower hinge, and more rounded posterior side. I have therefore put a mark of doubt to the above name. M. Deshayes has figured and described another shell under the name of *C. Deshayesii*, Hébert, which rather more resembles our shell in having a more pointed posterior side, but the umbo is less prominent, and the shell more inequilateral as well as larger.

I have left our shell, therefore, as Mr. Prestwich originally referred it, until the French and English specimens can be closely compared. The description given by Melleville of his species agrees better with our shell than does the figure he has given. On the other hand, the figure given by Sandberger of *intermedia* more resembles the English fossil, but is larger.

8. Cyrena? pullastra, *S. Wood.* Tab. A, fig. 11.

Length, 1½ inch; *height,* 1 inch.

Locality. Dulwich. (*Meyer.*)

The specimen figured is from the cabinet of Mr. Meyer, and it is the only one that I have seen. On the tablet Mr. Meyer had written *Cyrena* or *Unio*? The two valves are so firmly united by the matrix that I am, like Mr. Meyer, doubtful as to what genus it ought to be referred, but as it appears to be not very far removed from *Cyrena Dulwichiensis,* I have provisionally retained it under the same genus; and it may possibly even prove to be only a variety of that shell. Its shape so much resembles the genus *Tapes* or *Pullastra* that I have thought the latter a suitable specific appellation.

9. Cyrena trigona, *Deshayes.* Tab. A, fig. 9 *a*—*c.*

Cyrena trigona, *Desh.* Coq. Foss. des Env. de Par., t. i, p. 118, pl. xix, figs. 16, 17, 1824.
— — *Id.* An. sans Vert. du Bas. de Par., t. i, p. 513, 1860.

Spec. Char. "*C. Testâ ovato-trigonâ, minimâ, crassâ, lævigatâ, cordiformi, obliquâ; umbonibus productioribus, recurvis; dentibus cardinalibus tribus, duobus in alterâ* (*valvâ*) *lateralibus serratis.*" (*Desh.*)

Length, ⅜ths of an inch.

Localities. Britain: Dulwich. (*Meyer.*)
France: Lysi, près Épernay.

A very perfect specimen (fig. 9 *c*), with the umbones in apposition, has been sent to me for examination by Mr. Meyer; and although I have only the figure of the French species for comparison, I think there is no doubt but that the British fossil is identical with it. The valves lie on the clay with only the exterior exposed. Another specimen (fig. 9 *a*, *b*) from Sundridge Park I have regarded as belonging to the same species, though it has a more depressed umbo, and wants the subangular ridge on the posterior

side.[1] This latter specimen very closely resembles the small variety of the Crag and Post-glacial species, *C. fluminalis*, the only difference between them that I can detect being the greater length of the lateral teeth in *fluminalis*, and in the ridges or imbrications present on that species, the exterior of the Eocene shell being smooth. As, however, the ridges which are so strong on recent specimens of *fluminalis* become more or less obscure in the fossil, it is possible that the Eocene species, *trigona*, may not in life have been so destitute of imbrications as the specimens preserved fossil appear to be. *C. trigona* also closely resembles *C. pisum*, and is not far removed from *C. breviuscula*, Desh, 'An. sans Vert. du Bas. de Paris,' Pl. 36, figs. 9—11 ; but this latter shell is more transverse.

10. Cyrena anceps, *S. Wood.* Tab. A, fig. 12.

Length, 1 inch.

Locality. Dulwich (*Meyer*).

This represents another specimen sent to me by Mr. C. Meyer, and on the label was written, "Cyrena, a doubtful form," and said to come from the leaf clay at Dulwich. Its peculiarity seemed to me deserving of a special representation, and I have assigned it the above specific name, although it may only be a distorted specimen of *cuneiformis*, or of another of the common species from the same locality.

11. Cyrena tumida, *S. Wood.* Tab. A, fig. 7 *a*, *b*.

Length, $1\frac{3}{8}$ths of an inch.

Locality. Dulwich (*C. Evans*).

This is another doubtful form. It somewhat resembles in outline *C. cuneiformis*, but I have never seen a specimen of that species inflated like the present one. The one figured is the only specimen that I have seen, and I have provisionally, therefore, assigned it as a new species under the above name. The two valves were so closely cemented together by its stony matrix that I have been unable to see the interior. It is from the cabinet of Mr. C. Evans.

[1] These two characters have not been sufficiently represented by the artist in fig. 9 *a*, *b*.

12. Cyrena tellinella, *Férussac.* Tab. A, fig. 13 *a—c.*

Cyrena tellinella, *Fér.* Hist. des Moll. Terrest. Fluv., tab. sans No., fig. 1, 1819.
— — *Desh.* Coq. Foss. des Env. de Par., p. 123, pl. xix, figs. 18, 19, 1824.
— — — An. s. Vert. du Bas. de Par., p. 507, pl. xxxviii, figs. 3, 4, 1860.
— — *J. Lowry.* Chart Brit. Tert. Foss., pl. iv, 1866.
— — *Sandberger.* Land- und Sussw.-Conch., p. 179, t. viii, fig. 5, 1870.

Spec. Char. C. "*Testâ ovato-elongatâ, transversâ, inæquilaterali, lævigatâ, depressâ; umbonibus minimis; dentibus cardinalibus minimis, duobus in utráque valvâ, lateralibus magnis, obliquè striatis.*" (*Desh.*)

Length, 1 inch; *height,* ½ an inch.

Localities. Britain: Charlton (*S. Wood*), Woolwich, Upnor, New Cross (*Morris*).
France: Lignites, près Epernay.

This species is of a marked character, and well distinguished from all others of this genus met with in England; and its peculiarly elongated form has even been considered as a sufficient distinction to entitle it to be proposed as a new genus under the name of *Loxoptychodon,* but I think that character alone is insufficient for generic removal. The hinge is strong, with three cardinal teeth, of which the central one is bifid. There are also two lateral teeth, of which that on the posterior side is very elongated and somewhat remote, and both of them rugose or striated, the nymph or fulcrum for the external connector being sharp, long, and slightly prominent. The species was abundant at Charlton. M. Deshayes has described and figured two varieties of this species, one somewhat larger than the other, and also larger than any specimen that I have seen from our English beds.

This species is given by M. Deshayes as from the "Sables moyens" in France, as well as from the "Lignites." I have seen the British specimens only from Woolwich and Charlton.

13. Cyrena semistriata, *Deshayes.* Tab. B, fig. 1 *a, b.*

Cyrena semistriata, *Desh.* Ency. Méthod. Vers., t. xi, p. 52, No. 17, 1830.
— — *Id.* An. sans Vert. du Bas. de Par., p. 511, pl. xxxvi, figs. 21, 22, 1860.
— — *Nyst.* Coq. Foss. de Belg., p. 143, tab. vii, fig. 3, 1843.
— — *Morris.* Mem. Geol. Surv. (Isle of Wight,), p. 146, pl. ii, figs. 1, 2, 1856.
— — *Sandberger.* Land- und Sussw.-Conch., p. 309, tab. xx, fig. 2 *a, b,* 1872.

CYRENA CUNEIFORMIS, *Goldf.* Petr. Germ., t. xi, p. 224, pl. 146, fig. 2, 1838.
— TRIGONA, *Id.* Idem., figs. 3, 4.
— SUBARATA, *Bronn.* Leth. Geogn., t. xi, p. 958, pl. xxxviii, fig. 2, 1854.

Spec. Char. C. Testâ crassâ, ovato-trigonâ vel cuneiformi, obliquè cordatâ, inæquilaterali, posticè angulatâ, anticè rotundatâ, striatâ, striis transversis imbricatis conspicuis, posticè obsoletis, cardine bidentato, dentibus lateralibus lævigatis.

Dimensions. $1\frac{3}{8}$ths by $1\frac{1}{8}$th of an inch.

Localities. Britain: Hempstead, Bembridge (*Morris*).
France: Sables supérieurs (*Deshayes*).
Belgium: Klein Spauwen (*Nyst*).

This is said by Mr. Morris ('Mem. Geol. Survey,' 1856, p. 146) to be very abundant in Hempstead Cliff, and the specimens to be variable in form; but this variation appears to be principally in a more or less extension of the posterior side of the shell, some being more elongated than others. It resembles *C. cuneiformis* in outward form and in its variability, and is intermediate between it and what I have called *strigosa*, which is strongly and regularly ridged over all parts of the shell. The present species is not only distinguished from the two first mentioned by its exterior markings, but the hinge is narrower, with smaller denticles, the angular ridge on the posterior region is more strongly marked, and the lateral denticles are not striated. In well-preserved specimens there are, as Mr. Morris remarks, from five to seven radiating bands of colour upon the outer surface, such as may be seen on other species of this genus.

14. CYRENA BRITANNICA, *Desh.* Tab. B, fig. 2 *a*, *b*.

CYCLAS DEPERDITA, *J. Sow.* Min. Con., tab. 162, fig. 1, 1817.
CYRENA — *Morris.* Cat. Brit. Foss., 2nd edit., p. 200, 1854.
— BRITANNICA, *Desh.* An. sans Vert. du Bas. de Par., t. i, p. 501, 1860.

Locality. Charlton (*J. Sowerby*).

I have been unable to discover the specimen from which James Sowerby figured and described this species, or to learn of any other specimen having been found, and inasmuch as Mr. Sowerby speaks of it in 'Min. Con.' as a common species at Charlton, I should have supposed that he was labouring under some mistake about it, were it not that his well-known accuracy of delineation precludes the idea of his not having had before him some shell of which his figure is a fairly correct representation; and as this representation is obviously of some species of the genus *Cyrena*, and of one unlike any of the others known and described from English Eocene deposits, I have felt it necessary to have his figure copied into my plate, and to give the species among the British Eocene *Cyrenæ*.

Cyclas deperdita of Lamarck, to which J. Sowerby referred his specimen, is a different shell, and as the specific appellation of *deperdita* had been applied by Lamarck to a species of *Cyrena*, Mr. Deshayes proposed for Sowerby's shell the specific name of *Britannica*, and I have accordingly adopted his proposition.

15. Cyrena obovata, *J. Sowerby*. Tab. B, fig. 3 *a—d*.

Cyclas obovata, *J. Sow.* Min. Conch., t. 162, figs. 5, 6, 1817.
Cyrena — *Morris*. Catal. Brit. Foss., 2nd edit., p. 200, 1854.
— (corbicula) obovata, *Sandb.* Land- und Sussw.-Conch., p. 261, t. xv, figs. 2, 2 *a*, *b*, 1872.

Spec. Char. C. Testâ variabili crassâ, subcordatâ, posticè angulatâ, anticè convexâ, extus lævigatâ aut irregulariter striatâ; umbonibus elevatis; dentibus lateralibus inæqualibus.

Length, $\frac{7}{8}$ths of an inch; *height*, $\frac{3}{4}$ths of an inch, but variable.

Localities. Bembridge (*Morris*), Osborne (*Forbes*).

This is an abundant species in several parts of the Isle of Wight, and as it is variable I have had two different forms represented. Its principal distinction or, I ought to say, its claim to specific isolation, is a more prominent umbo, great tumidity, and an angularity on the posterior side. Some old specimens have a thick shell in which the impressions from the adductors are very deep. The large specimen figured by Mr. Sowerby, Tab. 162, fig. 4, and said to be from New Cross, shows a more rounded exterior than any I have from the Isle of Wight; and if it be referable to this species it must be a very aberrant form. Probably, however, it belongs to some other species as the locality, "New Cross," would imply that it came from the Woolwich Beds (Lower Eocene), whereas our Isle of Wight species belongs properly to the Upper Eocene. Mr. Whitaker in his Memoir Geol. Surv., 1872, gives at p. 577 this species as from Dulwich, with a mark of interrogation, but I have not been able to confirm it.

Mr. Morris in his Catalogue gives it from Barton, but I have not seen it from that marine locality. Mr. Sowerby has also given Barton as the locality for his figures 5, 6.

16. Cyrena obtusa, *Forbes*. Tab. B, fig. 13 *a—c*.

Cyrena obtusa, *Morris*. Catal. Brit. Foss., 2nd edit., p. 200, 1854.
— — *Forbes*. Mem. Geol. Surv., Isle of Wight, p. 149, pl. iii, fig. 4, 1856.
— — *J. Lowry*. Chart Brit. Tert. Foss., pl. ii, 1866.
— (batissa) obtusa, *Sandberger*. Land- und Sussw.-Conch., p. 311, t. xx, fig. 3 *a*, *b*, 1872.

Spec. Char. *C. Testâ lævi, convexâ, subtrigonâ, margine antico vix producto, margine postico angulato, subproducto, margine ventrali rotundato.*" (*Morris.*)

Length, $\frac{9}{16}$ths of an inch; *height*, $\frac{1}{2}$ an inch.

Localities. Bembridge, Hempstead (*Forbes*).

There is a considerable difference in the form of this shell from *C. obovata*, on which account I have kept it specifically distinct. A large series of each, however, might possibly remove the distinction and unite this with *obovata*. My specimens show a more rounded form than *obovata*, with a much depressed umbo and an absence of the strongly angular form of the posterior side of that shell. They are also less triangular and not so inflated. The species has been kept distinct by Messrs. Forbes and Morris, and I have thought it best to follow them in so doing.

The specimens of this species have undergone considerable erosion of the umbones, so much so that a specimen which I have had represented shows the cardinal teeth standing out prominently, and these are visible even when looking at the exterior of the shell.

17. Cyrena deperdita, *Lam.* Tab. B, fig. 10 *a—d.*

Cyclas deperdita,	*Lam.*	Ann. du Mus., t. vii, p. 425, 1803.
Cyrena	—	*Desh.* Coq. Foss. des Env. de Par., p. 118, pl. xix, figs. 14, 15, 1824.
—	—	*S. Wood.* Lond. Geol. Journ., p. 118, 1847.
—	—	*Morris.* Mem. Geol. Surv. (Isle of Wight), p. 156, pl. vii, fig. 11 *a*, *b*, 1856.
—	—	*Lowry.* Chart Brit. Tert. Foss., pl. ii, 1866.
—	—	*Sandberger.* Land- und Sussw.-Conch., p. 251, t. xiv, fig. 3, 1872.

Spec. Char. "*C. Testâ ovato-ventricosâ, obliquâ, subtrigonâ, lævigatâ substriatâve; umbonibus magnis, inflatis, recurvis; dentibus cardinalibus tribus valvâ sinistrâ, duobus dextrâ; dentibus lateralibus subæqualibus, lævigatis.*" (*Desh.*)

Length, $\frac{5}{8}$ths of an inch; *height*, $\frac{7}{16}$ths of an inch.

Localities. Britain: Hordle, Headon Hill (*Morris*).

France: Pontoise (*Deshayes*).

This is an abundant shell at Hordle in the purely freshwater deposit at the cliff of that locality, in association with the remains of the *Alligator*,[1] *Crocodile*, *Trionyx*, *Emys*, *Lepidosteus*, and sundry Mammalia, as mentioned by me in the 'Lond. Geol. Journ.' (1846), p. 6.

[1] All the vertebrate remains obtained by me from Hordle (which included many besides those figured in the 'London Geological Journal,' and among them the hitherto undescribed jaw of a Rodent and a bone of a Bird) were given by me to the National Collection in the British Museum in 1846.

In the Catalogue of Species from Hordle Cliff which I gave in that Journal, p. 118, I observed that this species and two others of Deshayes, *obliqua* (*obliquata*) and *cycladiformis*, were merely varieties of one species. I have, however, thought that it would be productive of less confusion, and facilitate the comparison of the French and English Eocenes, to adhere to Mr. Deshayes' specific determinations, more especially as my specimens appear to correspond with his figures and descriptions, and I have therefore done so.

Fig. 6 *a*, *b* represents a small and not well-determined species, of which Mr. Morris seemed doubtful when he figured it in the 'Memoirs of the Geol. Survey' by Forbes, as *Cyrena gibbosula*, Pl. vi, fig. 13. I have not seen the specimen, but have had the figure copied. It looks like a deformed specimen of *C. deperdita*.

18. Cyrena pisum, *Deshayes*. Tab. B, fig. 12 *a*, *b*.

Cyrena pisum, *Desh.* Desc. des Coq. Foss. des Env. de Par., p. 117, pl. xix, figs. 10—13, 1824.
— — *S. Wood.* Lond. Geol. Journ., p. 118, 1847.

Spec. Char. "*C. Testâ minimâ, subtrigonâ, globulosâ, lævigatâ; umbonibus inflatis, productioribus, obliquis; dentibus cardinalibus tribus, in alterâ binis, lateralibus subæqualibus admotis lævigatis.*" (*Desh.*)

Length, $\frac{5}{16}$ths of an inch; *height*, $\frac{1}{4}$th of an inch.

Localities. Britain: Hordle (*S. Wood*).
France: Houdan.

This shell is by no means rare in the sandy deposit at Hordle. It is difficult to separate it from *deperdita*, but that shell is more transverse, and not quite so tumid.

19. Cyrena cycladiformis, *Deshayes*. Tab. B, fig. 11 *a*, *b*.

Cyrena cycladiformis, *Desh.* Coq. Foss. des Env. de Par., vol. i, p. 121, t. xix, figs. 7—9, 1824.
— — *S. Wood.* Lond. Geol. Journ., p. 18, 1847.
— — *Morris.* Catal. Brit. Foss., 2nd edit., p. 200, 1854.
— — *Sandberger.* Land-Conch., p. 208, t. xi, fig. 3, 1872.

Spec. Char. "*C. Testâ ovatâ, transversâ, subæquilaterali, lævigatâ, tenui, fragili; umbonibus minimis; dentibus cardinalibus tribus valvâ dextrâ; duobus in alterâ, posticalibus bifidis; dentibus lateralibus lamellosis, minimis lævigatis.*" (*Desh.*)

Length, $\frac{5}{8}$ths of an inch; *height*, $\frac{7}{16}$ths of an inch.

Localities. Britain: Hordle (*S. Wood*).

France: Grignon, Ferme de l'Orme.

This species is not very rare in the purely freshwater deposit of Hordle. It is very transverse in form, with a narrow hinge and elongated lateral teeth, in which characters only does it appear to differ from *deperdita*. It is also slightly inequilateral and somewhat tumid, with a smooth exterior and a rather depressed umbo.

20. Cyrena obliqua? *Deshayes*. Tab. B, fig. 14.

Cyrena obliqua, *Desh.* Coq. Foss. des Env. de Par., t. i, p. 122, pl. 19, figs. 5, 6, 1824.

— obliquata, *S. Wood.* Lond. Geol. Journ., p. 118, 1847.

Spec. Char. "*C. Testâ ovato-transversâ, obliquâ, substriatâ, sub-æquilaterali; umbonibus obliquis, productiusculis, dentibus cardinalibus tribus, valvâ dextrâ, duobus, sinistrâ, lateralibus minimis; latere antico lævigato, postico tenuissimè striato.*" (*Desh.*)

Length, $\frac{9}{16}$ths of an inch; *height*, $\frac{3}{8}$ths of an inch.

Localities. Britain: Hordle (*S. Wood*).

France: Soissons (*Deshayes*).

A few specimens are in my cabinet, which appear to correspond with the French fossil which M. Deshayes originally constituted a distinct species in his first work on the fossils of the Paris Basin, and has preserved in his more copious and recent work, 'An. Foss. du Bas. de Par.,' p. 506. This is the shell spoken of by me in the 'London Geol. Journal' as *obliquata*, and there regarded by me as a variety of *deperdita* and *cycladiformis*. Probably M. Deshayes' suite of specimens of the three forms show greater differences than mine, and justify the separation.

21. Cyrena pulchra, *J. Sowerby*. Tab. B, fig. 7 *a*, *b*.

Cyclas pulcher, *J. Sow.* Min. Conch., t. 527, fig. 1, 1826.

— pulchra, *Morris.* Catal. Brit. Foss., 2nd edit., p. 200, 1854.

— — *Forbes.* Mem. Geol. Surv. (Isle of Wight), p. 148, pl. iii, fig. 1, 1856.

Cyrena — *J. Lowry.* Chart Brit. Tert. Foss., pl. ii, 1866.

— — ? *Sandberger.* Land-Conch., p. 308, t. xx, figs. 1, 1 *a*, 1872.

Spec. Char. C. Testâ crassâ, suborbiculari, subæquilaterali, anticè paulo minore, posticè dilatatâ, obtuse angulatâ, lævigatâ vel irregulariter striatâ, umbonibus prominulis, cardine crassiusculo; dentibus inæqualibus, in valvâ sinistrâ duobus primis majoribus, in

dextrâ posterioribus dentibus duobus bifidis, dentibus lateralibus inæqualibus, lævigatis; nymphis depressis.

Length, $2\frac{1}{8}$th of an inch; *height*, 2 inches.

Localities. Britain: Hempstead, Bembridge (*Forbes*).
(and var. *Wrightii*) Headon beds, I. of Wight.

This is a large and handsome shell, and deserving of the name given to it by Mr. Sowerby, and I believe it is abundant at the above localities. It somewhat resembles *C. Lamberti*, Desh., p. 495, pl. xxxix, figs. 9, 10, but differs in several particulars from the figure and description of that species, which has a much longer fulcrum or support for the ligamentous connector.

The shell figured as *C. Wrightii*, Forbes, in the 'Memoirs of the Geol. Survey,' is there regarded by Mr. Morris as a variety only of *pulchra*; and following the opinion of so sound an authority, I have not given *Wrightii* here as a separate species.

22. Cyrena arenaria ?, *Forbes*. Tab. B, fig. 8 *a*, *b*.

Cyrena arenaria, *Morris*. Catal. Brit. Foss., 2nd edit., p. 199, 1854.
— — *Forbes*. Mem. Geol. Surv., Isle of Wight, p. 88, 1856.

Spec. Char. C. Testâ suborbiculari, subæquilaterali, tenui, concentricè et irregulariter striatâ, umbonibus depressiusculis, areâ cardinali angustâ; dentibus lateralibus elongatis inæqualibus.

Diameter, $1\frac{3}{8}$ths of an inch.

Locality. Headon Hill (*S. Wood*).

The present shell was found by myself at Headon Hill half a century ago, before any divisions of the Isle of Wight series had been worked out, and I am unable to say to which division of the fluvio-marine group it may belong. I have given it under the above name with doubt, in consequence of Forbes' species *arenaria* not having been figured or described. The hinge of the specimen figured is much narrower than is that of *pulchra*, and the shell itself is much thinner than in that species. Two of the cardinal teeth in each valve are bifid, but the lateral teeth are narrower and more elongated than those of *pulchra*, but none of them are quite perfect.

23. Cyrena tenera, *S. Wood*. Tab. B, fig. 9.

Spec. Char. C. Testâ tenerâ, ovato-oblongâ, lævigatâ; valdè inæquilaterali, extremitatibus obtusis, umbonibus minimis depressis, obliquis; cardine angusto.

Length, 1 inch; *height*, $\frac{3}{4}$ths of an inch.

Locality. Headon Hill (*S. Wood*).

Two specimens of what I have here considered a new species were found by myself at the above locality fifty years ago, and I am unable to refer them to any particular division of the beds that make up Headon Hill. Unfortunately, also, both of them have the hinge not quite perfect, but they undoubtedly belong to the present genus. The exterior and outline of my shell appear to come very near to the figure of *Cyrena angustidens*, Melleville, given by Deshayes in 'An. sans Vert. du Bas. de Par.,' t. i, pl. 37, figs. 1, 2 (p. 515). My shell, however, seems from M. Deshayes' figures to differ from *angustidens* in being thinner. It is also less elongated than the figure given of that same species by M. Melleville, who speaks of it as "épaisse, assez profonde et très oblique." So far as its imperfect state allows of an opinion, also, the hinge of the British fossil seems to be narrower. Under these circumstances, and as the French species is described as occurring only in the "Sables Tert. inférieurs," while mine comes probably from a higher horizon, I have thought it better to give my shell provisionally under a separate name, though strongly suspecting its identity with the French species above mentioned.

Cyrena transversa, Forbes, is figured in Pl. III of the 'Geological Survey Memoir on the Isle of Wight,' described at p. 149 of the same memoir in the following words:

"Testâ transversâ, depressâ, angustâ, inæquilaterali, lævi posticè productâ, truncatâ, anticè attenuatâ, rotundatâ, margine ventrali leviter arcuato."

The interior of the shell is, however, not represented, nor is the dental furniture described; and judging from the figure given, it appears to me doubtful if it belongs to the present genus.

CYCLAS, *Bruguière*, 1792.

Sphærium. *Scopoli*, 1777.

Generic Character. Shell equivalve, subequilateral, more or less ventricose, thin, and closed; smooth or slightly marked by lines of growth. Hinge with a single cardinal tooth in one and two in the other, and a distant lateral tooth in each valve. Impressions of the adductors shallow or indistinct. Palleal impression small; connexus ligamental or external.

Priority of name (as stated in 'Crag Moll.,' vol. ii, p. 106) properly belongs to *Sphærium* of Scopoli, but *Cyclas* has been so long in use and has been so generally

adopted that I did not then and do not now consider it necessary to alter it; and I have therefore retained the name of *Cyclas*, following thus the example of several other modern conchologists. This has been justly separated from *Cyrena*, which is a thick and strong shell. Another division has been proposed under the name of *Pisidium* for some freshwater Bivalves very closely resembling those of *Cyclas*, being thin and semi-pellucid in the living state, like *Cyclas*, but having the shell a trifle more inequilateral, and presenting some difference in the siphon. Some of the Lower Tertiary fossils have been figured and described under each of these generic names, but those which I have seen may, I think, be referred to *Cyclas*.

1. Cyclas Bristovii? *Forbes*. Tab. B, fig. 5.

Cyclas Bristovii, *Forbes*. Mem. Geol. Surv. Isle of Wight, p. 146, pl. xi, fig. 3, 1856.
— — *Morris*. Catal. Brit. Foss., 2nd edit., p. 198, 1854.
— — *J. Lowry*. Chart. Brit. Tert. Foss., pl. ii, 1866.

"A small, somewhat quadrate and rather ventricose shell, the anterior margin rounded and the posterior truncated; the surface is concentrically marked by the fine lines of growth. This species presents considerable resemblance to a form from Headon Hill in Mr. Edwards's Cabinet."—*Morris*.

Length, $\frac{1}{8}$th of an inch; *height*, $\frac{1}{8}$th of an inch.

Locality. Hempstead (*Morris*).

A small shell apparently belonging to the genus *Cyclas* has been figured as above referred to, but it is insufficient for full description or comparison. A similar specimen is in my own cabinet, but, as it rests upon a piece of clay with its back uppermost, it cannot be satisfactory described. Mr. Morris, in the 'Geo. Survey Memoir,' has not given the characters of the hinge of the interior, so that some uncertainty attaches to his species.

M. Deshayes has figured and described three species with this generic name, and four with that of *Pisidium*. These are all said to be from Lignites or Sables inférieurs of France, but, judging from figures and descriptions, I cannot refer our shell to any one of his species.

Mr. Whitaker in his report upon the Woolwich Beds (p. 577), gives the name of "*Cyclas?* (a small Bivalve)" from Chiselhurst, but he informs me that he is unable to refer me to the specimen, and that it may be disregarded.

2. Cyclas tumidula, *S. Wood.* Tab. B, fig. 4 *a*, *b*.

Cyclas exigua? *S. Wood.* Lond. Geol. Journ., p. 118, 1847.

Spec. Char. C. Testâ minimâ, ventricosâ, tenui, ovato-transversâ, subæquilaterali, lævigatâ, glabrâ, anticè rotundatâ, obtusâ, posticè angustiore et latiore; umbonibus minimis, vix prominentibus, parum obliquis.

Length, $\frac{1}{4}$th of an inch; *height*, $\frac{3}{16}$ths of an inch.

Locality. Headon Hill (*S. Wood*).

The shell which I have here called *tumidula* appears to be more inflated than any other known to me. It is very smooth and glossy, with a short dorsal margin, the umbo slightly prominent, and the shell is nearly equilateral. It resembles from descriptions and figures two or three other species, viz., 1st *Cyclas Verneuilli* de Boissy, 'Mém. de la Soc. Géol. de France,' 2nd ser., t. iii, p. 270, pl. 5, fig. 5; figured also by M. Deshayes, 'An sans Vert. du Bas. de Par.,' pl. 34, figs. 40—42, but that shell does not appear so tumid as ours. 2nd. *Sphærium castrense*, Moulet, which has been figured and described by Sandberger, 'Land- und Süssw.-Conch.,' p. 221, tab. xiii, fig. 1, but this also appears less tumid and more transverse than my shell. 3rd. *Cyclas elegans*, Gould, 'Inv. Massach.,' p. 74, fig. 55, a recent species from the north-east coast of America. This latter approaches near to our Headon Hill shell, but is also less tumid. I have not been able to see the interior of my shell, but it seems to differ from *C. Bristovii* in being more tumid and equilateral.

In the year 1843 I found in the truly freshwater bed at Hordle a very small specimen of a shell belonging to this genus, to which I gave the name of *Cyclas exigua* in the 'London Geol. Jour.' Mr. Edwards not having in his cabinet a corresponding specimen, I gave him the one referred to under this name of *exigua*, but I have not been able to detect it in his collection now in the British Museum so as to determine whether it be the same as that now figured as *tumidula*, but to prevent confusion I have, under the circumstance of the shell apparently not having been preserved by Mr. Edwards, given it as the same as *tumidula*.

SCROBICULABRA. *S. Wood.*

When Mr. Morris described *S. Condamini* he was at a loss to know in what genus to place it; and not being able to see the hinge, he referred it provisionally to *Psammobia*.

M. Deshayes, in describing *Thracia Bazini*, considered it as not improbably the same shell as that described by Prof. Morris as *Psammobia Condamini*, although presenting some differences in exterior form which induced him to give it provisionally under a different specific name; and being, for a similar reason as that which influenced Mr. Morris, uncertain as to the genus he preferred rather to place it among *Thracia*.

Mr. Meyer has sent me several valves of *Condamini*, but they are all of them so fixed with the interior downwards in the indurated material as to preclude the possibility of the hinge being seen, but a single specimen of a shell so closely resembling *Condamini* in its peculiar external form as to leave little doubt of its being another species of the same genus has had the hinge worked out, so as to show pretty nearly its true characters; and I find that this does not correspond with the hinge of either of the genera to which *Condamini* has been thus referred, nor indeed does it strictly accord with any genus known to me. It will be seen from the specimen of *Dulwichiensis* figured (which is the right valve) that the hinge has a depression for the cartilage or connector sloping towards the posterior side, and there is also a very small slit at the umbo through which probably the cartilage protruded, and a similar slit may be seen in the genera *Thracia*, *Scrobicularia*, and *Abra*. Our fossil has also two large cardinal teeth diverging from the umbo at different angles; but it has no lateral teeth, and in that respect it differs from *Abra;* and although it has not quite so large or expanded a depression for the cartilage as *Scrobicularia*, yet in respect of its hinge it corresponds most nearly with that genus, appearing to be intermediate between it and *Abra*, having probably the habits of the former. I have in consequence erected the genus *Scrobiculabra* for its reception. Mr. Bott's specimen has unfortunately the interior nearly filled with indurated material, which obscures the muscle marks; and as this cannot be removed without danger to the integrity of the specimen, I am unable to give a proper diagnosis of the genus in question, and therefore prefer, beyond what is said above, not giving any rather than what might prove a partially incorrect one. The interior connector, like those of *Mactra*, *Mya*, and *Thracia*, has a slight extension outwardly, as if in those genera the compression and expansion of the cartilaginous connector were not quite sufficient for the purpose of the animal, without the assistance more or less of the external ligament to enable it to keep the margins apart.

1. Scrobiculabra Condamini, *Morris*. Tab. A, fig. 1.

Psammobia? Condamini, *Morris*. Geol. Journ., vol. x, p. 138, pl. ii, fig. 15, 1854.
— — *Watelet*. Cat. Moll. des Sables inférieurs, p. 16, 1870.
Thracia Bazini? *Desh*. An. sans Vert. du Bas. de Par., p. 267, pl. xv, fig. 3, 1860.
Psammobia Condamini, *Whitaker*. Mem. Geol. Surv., vol. iv, p. 577, 1872.

Spec. Char. "*Testâ ovato-transversâ, inæquilaterali, depressâ, subinæquivalvi, concentricè et irregulariter striatâ, margine antico rotundato, postico rostrato, attenuato, sinuato, margine postico sub-incurvato, declivi.*"—*Morris.*

Length. $1\frac{3}{8}$ths of an inch.

Localities. Counter Hill, Upnor (*De la Condamine*).
Charlton, Deptford (*A. Bott*), Dulwich (*Meyer*).

Mr. Meyer has sent me several specimens of this shell, all of which seem to correspond sufficiently with the figure given by Morris as to show that they are the same shell. The specimen figured by me is a left valve, while that figured by Mr. Morris is a right one; and, as before observed, none of Mr. Meyer's specimens allow of the interior being seen. Mr. Whitaker speaks in his memoir of a second species of *Psammobia* from the Woolwich and Reading beds of Theale, and of Castle Kiln, Reading; but as the specimens were, he informs me, only casts, it is of course impossible to specifically identify them, or to say whether they belong to the genus which I have called *Scrobiculabra*.

2. Scrobiculabra Dulwichiensis, *S. Wood*. Tab. A, fig. 16 *a*—*c*.

Spec. Char. S. Testâ tenui, elongato-ovatâ, subinæquilaterali; concentricè et obsoletè striatâ; umbonibus depressis; latere antico rotundato, latere postico obtusè angulato. Margine dorsali subangulata, margine ventrali late arcuato.

Length, 1 inch; *height*, $\frac{1}{2}$ inch.

Locality. Dulwich (*A. Bott*).

The specimen figured as above, and referred to in the remarks introducing the genus *Scrobiculabra* is unique, but the characters presented by its exterior appear to me to differ from those of *Condamini* so as to justify its specific separation, and I have accordingly assigned it the name of *Dulwichiensis* from the place of its occurrence.

SPHENIA. *Turton*, 1822.

Generic Character. "*Testâ transversâ, inæquivalvi, inæquilaterali, latere antico hiante. Cardo valvæ sinistræ dente elevato transversim dilatato, dextræ dente concavo cum denticulo postico; lateralibus nullis. Ligamentum internum.*"—*Turton.*

The principal difference between this and *Mya* is in the impression of the mantle, which in *Mya* has a large, broad, and deep sinus. Messrs. Forbes and Hanley have given a representation of the animal inhabitant, which shows it to be different from that of *Mya*. There is also a difference in the dental furniture of the shell, the projecting support for the connecting ligament being more extended backwardly in the left valve, while in the right one there is a distinct denticle.

1. Sphenia ? angustata, *J. Sowerby.* Tab. B, fig. 15 *a*, *b*.

Mya ? angustata, *J. Sow.* Min. Conch., t. 531, fig. 1, 1826.
— — *Morris.* Catal. Brit. Foss., 2nd edit., p. 212, 1854.
— — *J. Lowry.* Chart. Brit. Tert. Foss., pl. ii, 1866.

Spec. Char. "Valves unequal; transversely elongated, thin, antiquated, irregularly compressed; extremities obtuse, gaping; lower edge of the lesser (right) valve concave."—*J. Sowerby.*

Length, $1\frac{1}{4}$ inch; *height*, $\frac{5}{8}$ths of an inch.

Locality. Colwell Bay (*Forbes*).

This long-known shell has a projecting process like that of *Mya truncata*, on which the cartilaginous connector is placed, but not exactly of the same form; and the sinus made by the mantle is smaller, comparatively, and less deep than in *Mya*. Mr. Morris, when describing what is a closely allied species, if it be not indeed a variety of the same shell, in the Geological Survey Memoir upon the geology of the Isle of Wight, has given to it the name of *Mya* (*Panopæa*) *minor*, of which he gives two varieties. I feel at a loss what generic name to give to this shell, but it cannot be placed among the *Panopææ* because the ligament or connector is in each differently placed; *Panopæa* having a projecting ledge on the outside of the dorsal margin for the support of the connector, which acts by elongation and contraction; whereas in *Mya* and in our present shell the connector is situated within the margins, and opens the shell by expansion in opposition to the action of the adductor muscles.

2. SPHENIA? MINOR, *Forbes*. Tab. B, fig. 16 *a*, *b*.

MYA (PANOPÆA) MINOR, *Forbes*. Mem. Geol. Surv., p. 146, pl. ii, fig. 4; and p. 149, pl. iii, fig. 3, 1856.

Spec. Char. "Shell transverse, compressed, elongately-ovate, very inequilateral; the anterior side narrow, posterior side slightly dilate, the surface corrugated by lines of growth, giving it an obscurely sulcated appearance. The anterior is about one third as long as the posterior portion, and the width about half the length. The umbones are nearer the anterior margin than in *P. intermedia* (Sow.), and the surface is less corrugated than in *P. corrugata* or even *P. intermedia*."—*Morris*.

Length, $1\frac{1}{4}$ inch; *height*, $\frac{9}{16}$ths of an inch.

Localities. Bembridge and Hempstead (*Forbes*).

Mr. Morris, in describing Forbes' species in the Geological Survey Memoir on the Isle of Wight, gives two varieties of this shell.

I cannot myself perceive sufficient differences in this shell to justify its separation from *angustata*, J. Sow., but as I am unwilling to disturb prior determinations under the circumstances in which I am compelled to leave the description of the British Eocene Mollusca incomplete, I have retained the species here.

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PLATE A.

Fig.

1. Scrobiculabra Condamini, *p.* 21. Dulwich.
2 *a*—*c*. Cyrena cordata, *p.* 4. Dulwich.
3 *a*—*c*. „ cuneiformis, *p.* 5. Charlton.
4. „ strigosa, *p.* 5. Charlton.
5 *a*, *b*. „ Forbesii, *p.* 6. Charlton.
6. Unio Michaudi, *p.* 1. Dulwich.
7 *a*, *b*. Cyrena tumida, *p.* 9. Dulwich.
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16 *a*—*c*. Scrobiculabra Dulwichiensis, *p.* 21. Dulwich.

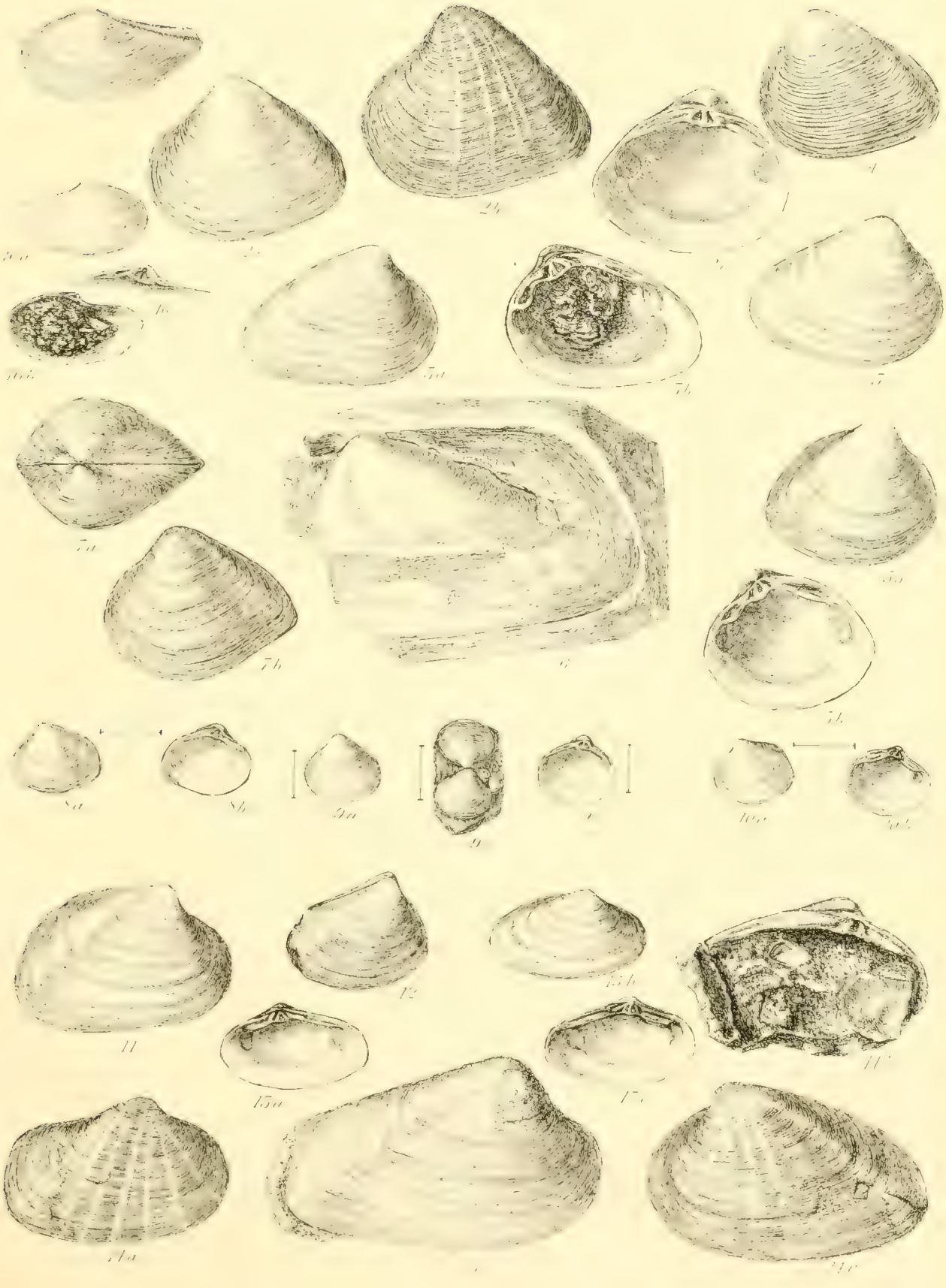

PLATE B.

Fig.

1 *a*, *b*. Cyrena semistriata, *p*. 10. Hempstead.
2 *a*, *b*. „ Britannica, *p*. 11. Woolwich ?
3 *a*—*d*. „ obovata, *p*. 12. Headon Hill.
4 *a*, *b*. Cyclas tumidula, *p*. 19. Headon Hill.
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10 *a*—*d*. „ deperdita, *p*. 13. Hordle.
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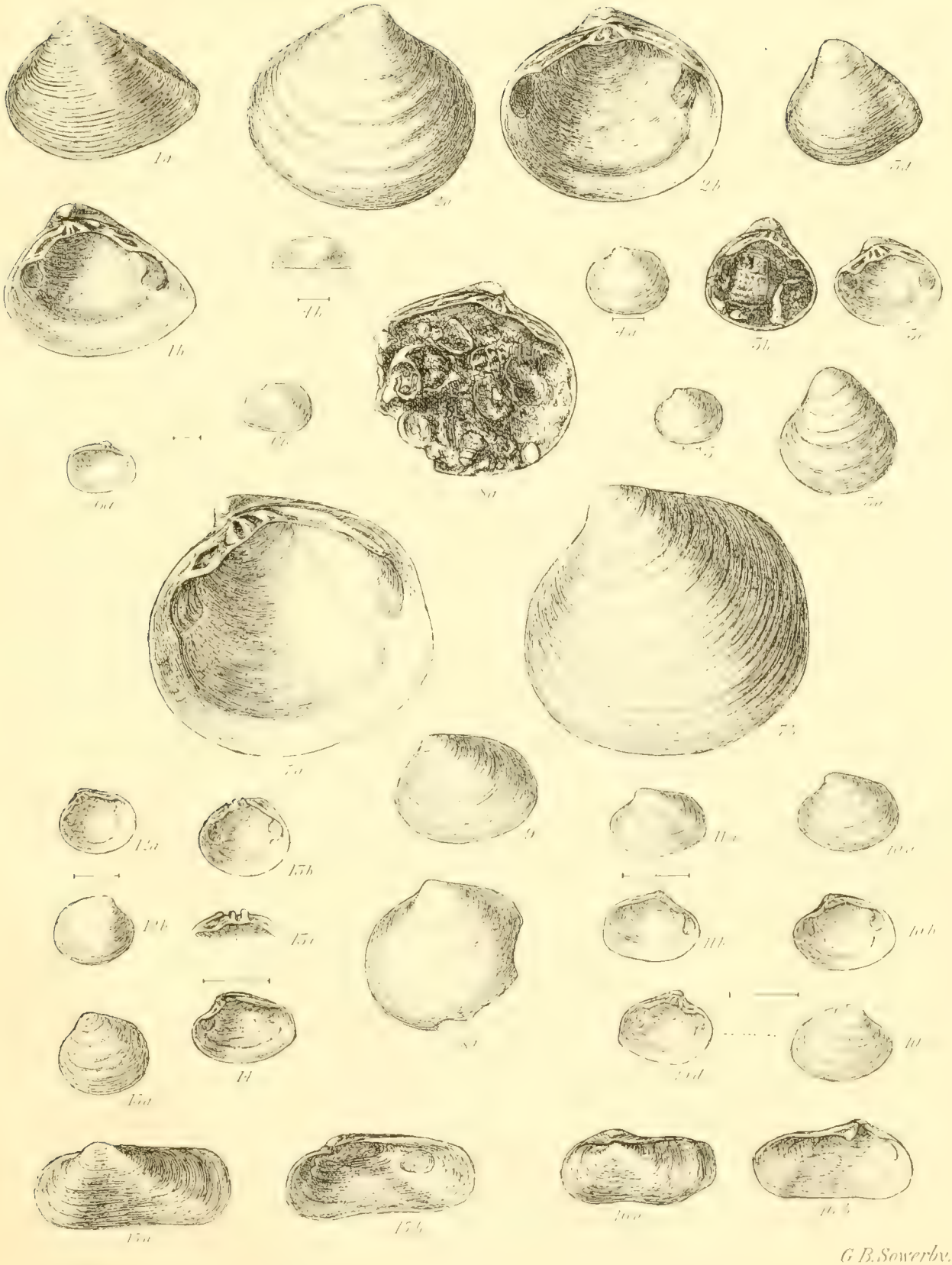
15 *a*, *b*. Sphenia ? angustata, *p*. 22, Colwell Bay.
16 *a*, *b*. „ minor, *p*. 23. Hempstead.



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